EDITORIAL

RADIO and TV should have a most interesting time during 1958. I don't expect any violent changes one way or the other in sales, but I think the pattern of things to come will show out more clearly than it has to date.

The initial period of TV establishment is almost over and, from now on, the public won't be so ready to be nice about poor programs and technical breakdowns. In fairness to all, TV stations do very much better these days, and show every evidence of having learned their business, even if the hard way.

From now on they will be expected to demonstrate what they can do, without favour or excuse.

The public is still buying sets, but the Xmas period has been a quiet one, and manufacturers are bound to try for reduced prices. Already we have seen cut prices in action, and I think this indicates more than merely a seasonal reaction.

One way to offer cheaper sets is to reduce screen sizes. For this reason we'll probably see some smaller sets added to the present range, balancing the 13-inch or smaller picture against appreciably lower cost. The popular favourite will continue to be the 21-inch set, but there must be a big market which still counts its pennies.

A TV set for £120 would have enormous appeal.

Phonevision seems likely to make its first real bid this year. By using rented devices on transmitters and receivers to scramble and unscramble the picture, Phonevision allows you to see special features on payment of a fee, part of which goes to finance their production.

The idea certainly has the potential to bring otherwise too-costly programs to the air. But it also puts great power in the hands of its operators, and we might find that practically everything worth seeing would cost an extra half-crown.

Only time will tell whether Australians will accept it.

So far nothing has been heard about the results of the FM inquiry. Many consider that nothing will come of it, but others believe that a start, even on a limited scale, is inevitable. I don't know. I think it would be a good thing to push ahead with both FM and new TV stations as rapidly as we can, and I believe our resources can stand it. One way or another, we should find a clearer answer during the coming year.

To all our readers we offer our best wishes and hopes for the new year. There are stimulating days ahead for us all.

John Moyle

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RADIO ★★ TELEVISION AND HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION HOBBIES AND POPULAR SCIENCE

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OUR COVER PICTURE

Manufactured in the U.S. by the Zenith Radio Corporation, this "Trans-Oceanic" radio is claimed as the "smallest, lightest, band-spread short-wave portable ever built". It has eight tuning ranges (2-9 Mc S.W.) uses transistors throughout and is powered by flashlight cells. See article, page 7.

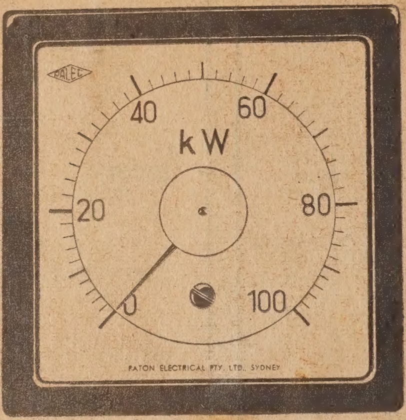
NEW!

CONCENTRIC SCALE 270°

A.C. AND D.C.

METERS

. . . extending the comprehensive range of high grade electrical indicating Meters made in Australia by Paton Electrical Pty. Ltd.


PALEC
40
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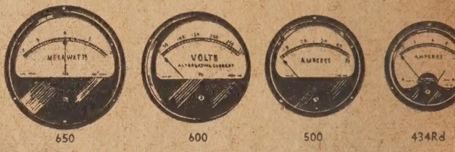
PATON ELECTRICAL PTY. LTD., SYDNEY

12 inch scale length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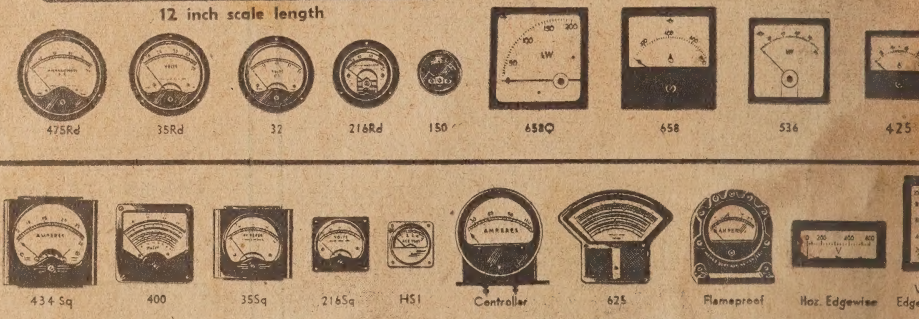
475Rd
35Rd
32
216Rd
150
658Q
658
536
425
434 Sq
400
35Sq
216Sq
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SERVICE: Our Australian-built products have the advantage of being backed by local factory service.

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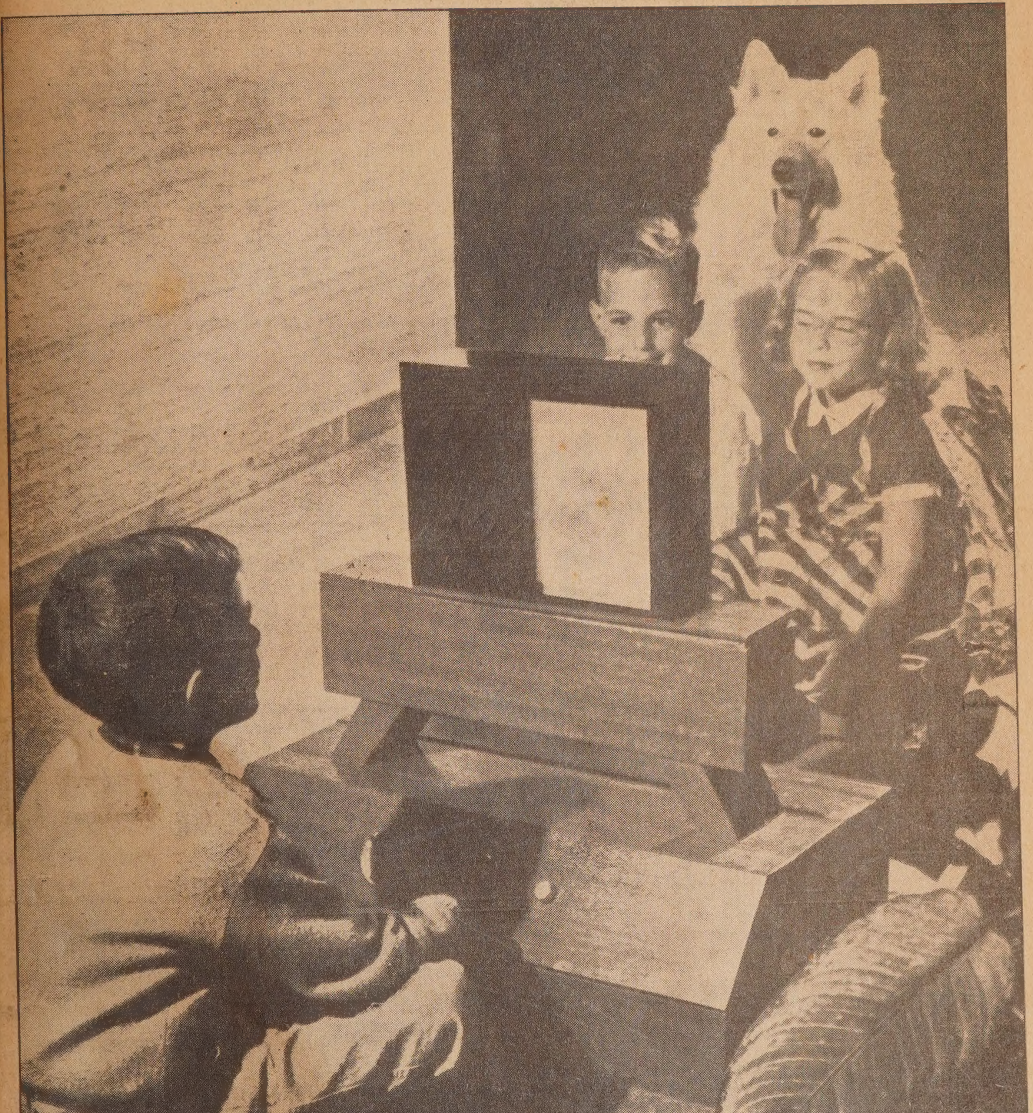
NEW TV SET LOOKS BOTH WAYS



Children — and a dog — watch a new prototype television set, which shows a picture simultaneously on both sides. The set uses a newly developed Kaiser-Aiken thin cathode-ray tube, adapted to a conventional receiver. Developed by the Kaiser Aircraft and Electronics Corporation, the tube is a basic component of an Army-Navy program to simplify aircraft instrumentation and operation. The tubes, approximately 2-5/8 inches thick, need only refinements of their glass envelope for mass production to make space-saving TV a reality — plus the advantage of being able to see the picture from both sides of the screen.

Senior Soviet Engineer E. Sobolevsky observing the zone of radio signals of the second artificial satellite at the tracking station at the Ministry of Communication.

The Inside Story Of Sputnik No. 2

This article is made up of extracts from an official Russian document issued to cover the launching of the two Sputnik earth satellites. The photographs came from the same source and, although not highly informative, they are authentic. The article confirms a number of technical points, which have thus far been assumed and supplements other information on the subject on page 11.

SPUTNIK No. 2 was aligned on its orbit by means of a multiple-stage rocket. In the process of alignment the rocket rose to a height of several hundred kilometres away from the ground, and then its last stage turned to move parallel to the ground at a speed of more than 8,000 metres a second, becoming a sputnik. At the moment of alignment on orbit the stocks of fuel in the rocket's tanks had been expended and the engine had burned out. The sputnik continued to move due to the kinetic energy acquired from the take-off.

The speed imparted to the final stage of the rocket was greater than the velocity required to have the sputnik travel along a circular orbit at a constant altitude of that of the point of alignment on orbit. For that reason, the sputnik follows not a circular orbit but an elliptical orbit of which the apogee is about 1,700 km, almost double the apogee of Sputnik No. 1. Since the size of the major semi-axis of the orbit of Sputnik No. 2 is greater than that of Sputnik No. 1, the period of its revolution round the Earth is also greater, being 103.7 mins. at the beginning of its flight.

NUMBER OF REVOLUTIONS

Owing to the increased period of revolution, Sputnik No. 2 makes about 14 full revolutions round the Earth in 24 hours, whereas Sputnik No. 1 made about 15 revolutions at the very beginning. The shift of each turn of the spiral along the line of longitude due to the Earth's sidereal rotation is roughly a fifteenth bigger for Sputnik No. 2 than for Sputnik No. 1. The distance apart between two turns of the ground spiral has accordingly increased by the same value.

Present systematisation of the results of trajectory measurements will enable us to determine fully the entire process o the evolution of the orbital parameters of both sputniks an obain important information about density distribution in th top layers of the atmosphere. Later, we shall be able t forecast reliably how long sputniks will live.

Sixty-six special optical observatories, every astronimica observatory of the Soviet Union, and close to thirty othe observatories in other countries are tracking the first two sputniks and the carrier rocket of the first sputnik.

ORIENTATION IN SPACE

As a result of optical observation, it has been determine that the carrier rocket changes its shine. This is brought abou by changes in its orientation in outer space. The shortes registered visual period of the shine is approximately 2 seconds.

Of great importance are the measurements of the intensity of the field of radio signals received from the sputniks These measurements were made by continuous automatic writing machines and by individual measurements taken at definit intervals.

The results of the measurements of the intensity of th field of radio signals have made it possible to evaluate th absorption of radio waves in the ionosphere, including thos areas which lie above the maximum ionisation of the mai ionospheric layer F2 and therefore are unaccessible to ordinar measurements taken from the Earth' surface. These measurements permit u to judge of the possible means of transmitting radio waves in the ionosphere.

The results of radio signals receive from the sputniks and the measurement of their levels has determined that thes signals on the 15-metre band were received at distances far exceeding thos determined by direct vision, for they wer as great as 10, 12 and even 15,000 kilometres, and in some cases even greater

Interesting results have been obtained on the basis of Dopper's Effect by tape-recording the changes in the tone o beats between the frequency of radi waves sent out by the sputnik and the frequency of vacillations of the loca heterodyne. Many such tape recordings have been made, and their results are now being analysed.

The total weight of the package of equipment, the test animal and the electric batteries in Sputnik No. 2 is 508.3 kg.

In the nose of the final stage of the rocket, fixed to a special frame, are instruments for studying solar radiation in the ultra-violet and X-ray regions of the spectrum, a spherica container fitted with radio transmitters and other instruments, and a hermetically sealed chamber with a test animal (a dog) inside.

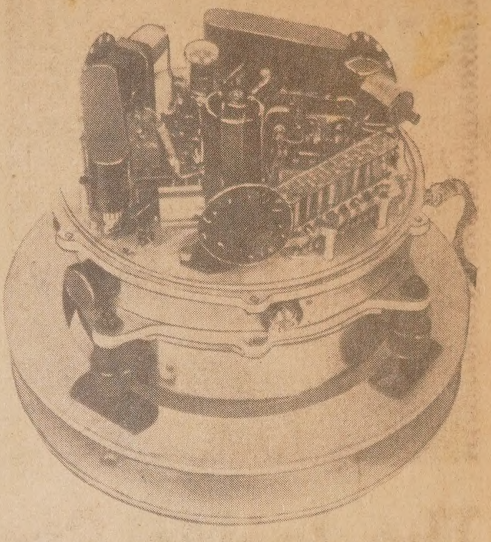
COSMIC RAY RESEARCH

The apparatus for cosmic ray investigation is fixed to the rocket's body. The devices and containers installed in the rocket are shielded from the aero-dynamic and heat effects of the rocket's passage through the dense layers of the atmosphere by a special protective cone. After the last stage of the rocket was established on its orbit, the protective cone was discarded.

The radio transmitters, placed in the spherical container functioned on frequencies of 40.002 and 20.005 megacycles pe second. The electric batteries, the heat regulation arrangement and also sensitive elements for recording temperature fluctuations and other parameters were also placed in this container In structure the spherical container resembles the first sputnik

The signals emitted by the radio transmitter working on 20,005 megacyles (15 metres) were of a telegraphic order averaging around 0.3 secs. in length, with a pause of the same time in between. Due to changes in some of the parameters inside the spherical container (temperature and pressure) the length of the signal and the pause also changed within definite limits.

HEART OF SPUTNIK 2



This photograph, unfortunately without annotations, shows the general makeup of the sputnik 2 instrumentation.

The transmitter working on 40.002 megacycles (7.5 metres) functioned under a continual emission system. The conformity of the two transmitters to the indicated frequencies ensured investigation of the propagation of the radio waves emitted from the sputnik and the measurements of its orbital parameters. Moreover, reception of signals from the sputnik in all ionospheric conditions was guaranteed.

The choice of the wave-lengths and also the ample power of the transmitters enabled the broadest community of amateur radio operators to track the sputnik, along with stations specially assigned this task.

The hermetically sealed chamber, in which the test animal was housed, was cylindrical in shape. To provide conditions to maintain normal life, it had a stock of food and an air-conditioning arrangement consisting of a regeneration installation and a heat regulation system.

Along with this, the chamber also had inside equipment for recording the pulse-beat, breathing and blood pressure, instruments for taking electrocardiograms and also sensitive elements for measuring a number of parameters characterising the conditions inside the chamber (temperature, pressure).

ALUMINIUM ALLOYS

Both the chamber for the test animal and the spherical container were made of aluminium alloys. They had a polished surface, specially treated to impart the required co-efficients of emission and absorption of solar radiance. The heat regulating arrangement inside the spherical container and the animal's chamber maintained the set temperature, deflecting the heat into the hull by compulsory gas circulation.

Apart from the indicated equipment, the body of the last stage of the rocket had on it radio-telemetering measuring equipment, instruments for temperature measurement, and electric batteries to feed the scientific and measuring instruments.

The temperature on the outer surface and inside the animal's chamber and also of the individual devices and elements was ascertained by means of temperature senders fixed on to them. The radio-telemetering equipment relayed to ground-borne stations all recordings of all the measurements taken on the sputnik. The broadcasting of this data was done periodically according to a special programmed arrangement.

Three special photo-electronic multipliers, set at an angle of 120 degrees to each other, serve as receptors of ultra-violet solar radiation. Each photo-multiplier is consecutively covered with several filters of thin metallic and organic film and also of special optical materials, making it possible to single out the different bands in the X-ray region of the solar spectrum, and the hydrogen line in the remote ultra-violet region. The electric signals given out by the photo-multiplier trained on the Sun were amplified by radio arrangements and telemetered to ground-borne stations.

SWITCHED BY SUN'S RAYS

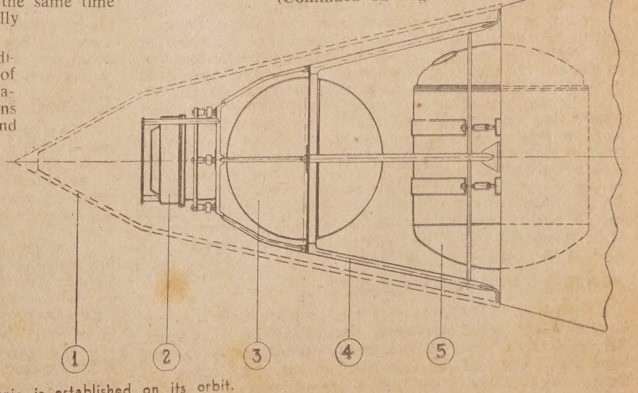
Owing to the continual change in the sputnik's bearings with respect to the Sun and also to the fact that part of its orbit was not lit by the Sun for a certain period of time, the electric circuits in the apparatus were switched on, in order to feed the batteries, only when the Sun came within the range of vision of any of the three light receptors. This was done by means of photo-resistors lit by the Sun at the same time as the photo-multipliers, and by an automatically working arangement.

Along with sputnik observation of solar radiation, this was done also by the entire network of ground-borne "Sun service" stations incorporated in the IGY program. These observations were carried on by astrophysical observatories and by stations studying the ionosphere and receiving the Sun's radio waves. Systematisation of all these observation materials will enable us to draw the first conclusions as to the connection between the Sun's ultra-violet and X-ray radiation and the processes taking place in the Sun's chromosphere and corona, and likewise the state of Earth's ionosphere. This data will pave the way for subsequent systematic observation.

To elucidate the nature of the changes cosmic rays undergo, we must not only establish the fact of the increase or decrease in the intensity of cosmic radiation but also determine how the number of particles with different energies will change. Moving at a speed of 8 km per sec., the sputnik crosses from one latitude to another in a very short space of time. Thus by sputnik measurements of cosmic radiation we can ascertain its latitude effect and thereby the distribution of particles of this radiation according to their energies. The fact that there is a great number of these measurements is particularly appreciated. Therefore, the sputnik will help us to trace not only the changes in the intensity of cosmic radiation but also in its composition.

The particles comprising cosmic radiation are recorded aboard the sputnik by means of counters of charged particles. When the counter gates an electrically charged particle, there arises a spark sending an impulse to a radio arrangement of semi-conductor triodes of which the designation is to count the number of cosmic ray particles and send out a signal when

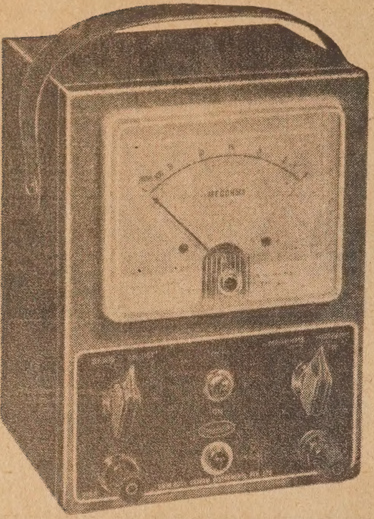
(Continued on Page 105)



This diagram shows the distribution of equipment in Sputnik 2

1. A protective cone, discarded after the Sputnic is established on its orbit.
2. Instrumentation for the investigation of ultra-violet and X-ray radiations of the sun.
3. Spherical capsule with instrumentation and radio transmitters.
4. A special frame to which instrumentation is secured.
5. A hermetically sealed chamber with a test animal.

3 UNIVERSITY INSTRUMENTS THAT GIVE YEARS OF ACCURACY AND SERVICE

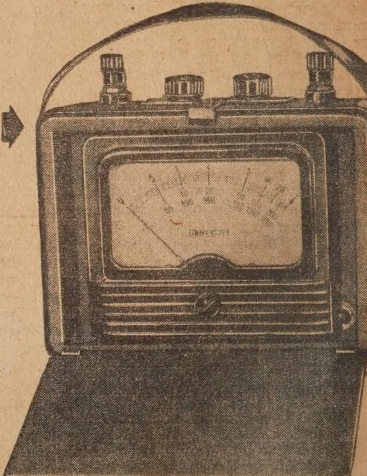


MEGOHM METER

This instrument is ideal for television purposes and other applications where high resistance values need to be checked. Its major uses are for checking resistance values, leakage paths and capacitor testing. In many cases it will take the place of a Megger and as it operates from power mains it leaves both hands free for other work. It is designed to operate from 240 volts AC and it is small and compact. Two ranges are provided of 0-100 megohms and 0-1,000 megohms. Both of these ranges are at a test potential of 1,000 volts. The available energy is extremely small and therefore the instrument is not dangerous or lethal.
Special terminals are provided which enables standard test leads to be plugged in or wires or components to be connected directly to the instrument.

◄ MODEL D10D

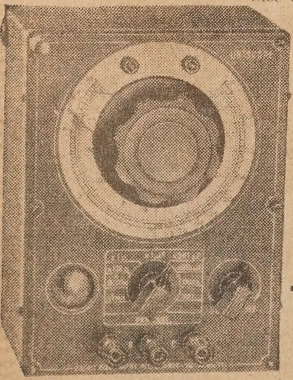
MODEL EXT/2 ►



LOW AND MEDIUM RANGE OHMETER

This portable and self contained instrument which covers resistance readings in several ranges has many applications in the Electrical Radio and Industrial fields. Small in size, this instrument uses a 4 inch square meter and is housed in a hard moulded rubber case which enables it to take heavy shocks and be unbreakable. The meter is protected by a metal flap which closes when the instrument is not in use. Ranges are:—

0-20 ohms (2 ohms centre)
0-500 ohms (20 ohms centre)
0-5000 ohms (200 ohms centre)
Size 6½" x 3".



◄ MODEL UBA

RESISTANCE CAPACITY TESTER, MODEL UBA

With the complex circuits in TV receivers employing many capacitors and many resistors, this special instrument provides a good standard of accuracy together with ease of handling. It covers an extensive range of resistance measurements from .1 ohm to 10 megohms and capacity measurements from 10 micro-microfarads to 10 microfarads. It is accurate and sensitive and is overload proof. A calibration system is incorporated to enable rapid checking of the apparatus at any instant, and internal standards are adjusted to an accuracy of plus or minus 1 p.c.

UNIVERSITY GRAHAM

INSTRUMENTS PTY. LTD.

5 NORTH YORK ST., SYDNEY.

PHONE BU3169

TRANSISTOR SET TUNES WORLD

Shades of things to come are illustrated by details of this new American Zenith receiver about to be released. Zenith have for some years made a world-range receiver using battery valves and with a wide-band coverage. Their latest model performs the same function, but is fitted throughout with transistors. It needs no aerials other than its own for good reception.

THE new receiver tunes eight wave bands to give reception from stations on international short-wave channels, plus ship-to-shore communications, marine and weather broadcasts and standard broadcast stations. Band-spread tuning on international short-wave bands electronically stretches the distance between stations on the dial to permit precision selection of even weak or far-distant transmitters.

The set is housed in a chrome-plated cabinet trimmed in black leather and was designed by one of the foremost industrial designers in the U.S. It is the size of an ordinary portable and is claimed to be the smallest and lightest band-spread short-wave set ever built. Weight, 13 pounds, including batteries, is half that of conventional short-wave portables.

It is designed to perform efficiently on trains, planes, boats, automobiles, in steel buildings and in extremes of climate.

STANDARD CELLS

Powered by standard flashlight batteries, available anywhere in the world, it will operate up to 30 hours on a set, many hours listening can be had for the cost of one penny. Transistor operation eliminates needs for tubes, high-cost "B" batteries, or electric power line connection.

Zenith engineers rate the receiver at 500 milliwatts of undistorted power output, 92 per cent greater than for any tube type short-wave portable. Its tone quality is also better.

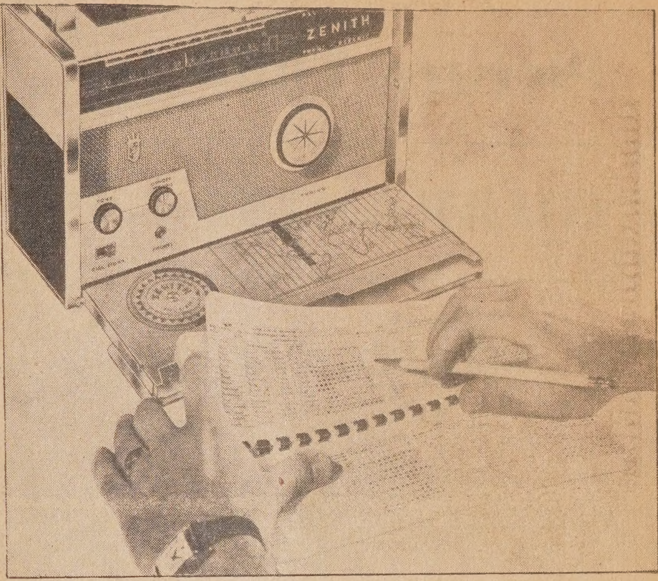
More than three years of intensive research, engineering and field testing have gone into the receiver. Engineering and tooling investment amounted to approximately £150,000.

There are three antennas: The telescoping Waverod, exclusively for short-wave use, which is concealed in the receiver handle when not in use; the built-in Wavemagnet antenna for normal reception of standard broadcasts; and the detachable Wavemagnet that increases sensitivity up to 300 per cent in trains, planes, automobiles, etc.

Front cover of the set houses a comprehensive set of log charts, listing all major short-wave stations of the world, with frequencies and times of best reception. Marine-weather broadcast schedules serving boats on the inland and offshore waters of the continental U.S. are also listed.

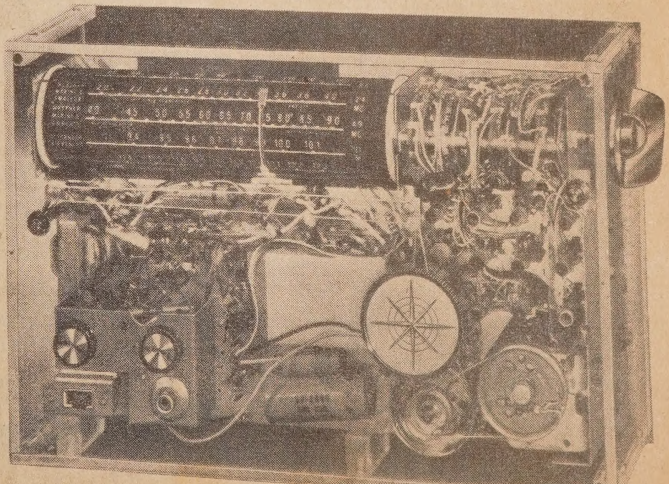
Other features of the set include: A

(Continued on Page 9)



Log charts in cover of Zenith's new all-transistor Trans-Oceanic✻ portable radio tell listener when and where to dial for best reception on international short wave, marine-weather, ship-to-shore channels. Supplies schedules and frequency settings, termology explanations etc., for marine weather broadcasts in Great Lakes Area Pacific and Atlantic coastal areas, Gulf of Mexico, Caribbean Sea and for U.S. river navigation. Also lists all major short wave stations of the world. Space is provided for listener's personal log.

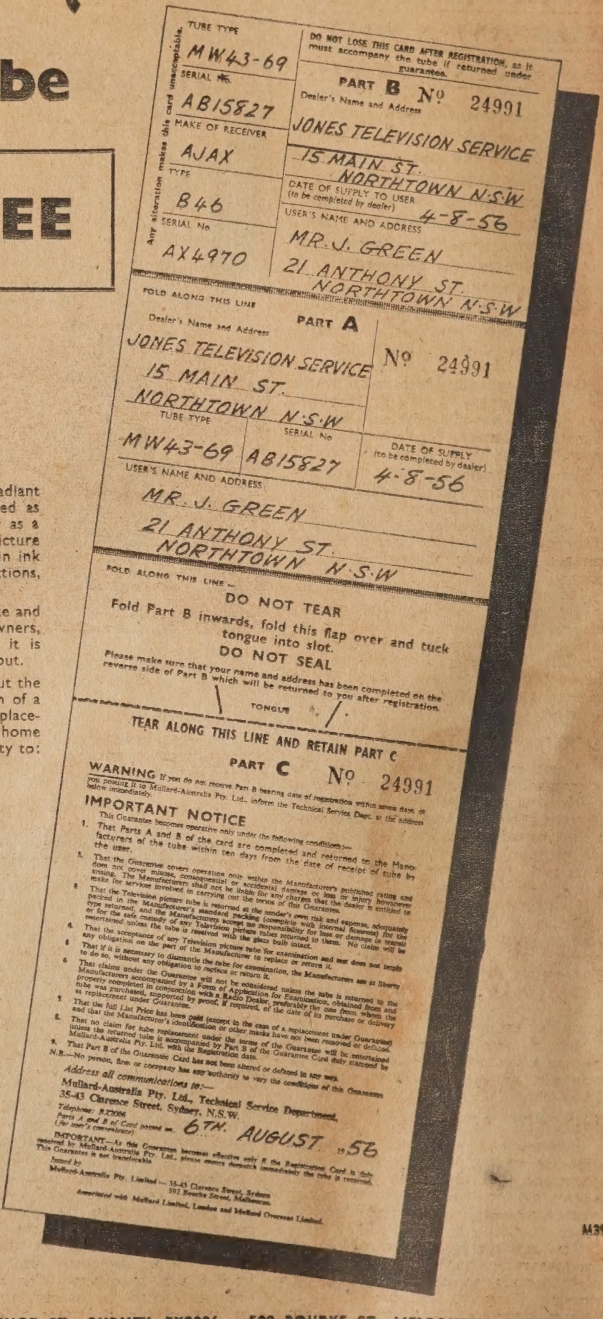
Inside story of the world's first all-transitor standard and band-spread short wave portable, Zenith's Trans-Oceanic✻ radio. Miniaturisation of components for use with transistors made possible global receiver that is by far the smallest and lightest band-spread short wave portable ever built.



Mullard *Radiant screen*

Picture Tube

GUARANTEE



Any alteration makes this card unacceptable.

TUBE TYPE MW43-69

SERIAL No. AB15827

MAKE OF RECEIVER AJAX

TYPE B46

SERIAL No AX4970

DO NOT LOSE THIS CARD AFTER REGISTRATION, as it must accompany the tube if returned under guarantee.

PART **B** Nº 24991

Dealer's Name and Address JONES TELEVISION SERVICE
15 MAIN ST.
NORTHTOWN N.S.W

DATE OF SUPPLY TO USER (to be completed by dealer) 4-8-56

USER'S NAME AND ADDRESS MR. J. GREEN
21 ANTHONY ST.
NORTHTOWN N.S.W

FOLD ALONG THIS LINE

PART **A** Nº 24991

Dealer's Name and Address JONES TELEVISION SERVICE
15 MAIN ST.
NORTHTOWN N.S.W

TUBE TYPE MW43-69

SERIAL No AB15827

DATE OF SUPPLY (to be completed by dealer) 4-8-56

USER'S NAME AND ADDRESS MR. J. GREEN
21 ANTHONY ST.
NORTHTOWN N.S.W

FOLD ALONG THIS LINE

DO NOT TEAR

Fold Part B inwards, fold this flap over and tuck tongue into slot.

DO NOT SEAL

Please make sure that your name and address has been completed on the reverse side of Part B which will be returned to you after registration.

TONGUE

TEAR ALONG THIS LINE AND RETAIN PART C

PART **C** Nº 24991

WARNING If you do not receive Part B bearing date of registration within seven days of you posting it to Mullard-Australia Pty. Ltd., inform the Technical Service Dept. at the address below immediately.

IMPORTANT NOTICE

This Guarantee becomes operative only under the following conditions:—

1. That Parts A and B of the card are completed and returned to the Manufacturers of the tube within ten days from the date of receipt of tube by the user.
2. That the Guarantee covers operation only within the Manufacturer's published rating and does not cover misuse, consequential or accidental damage or loss or injury howsoever arising. The Manufacturers shall not be liable for any charges that the dealer is entitled to make for services involved in carrying out the terms of this Guarantee.
3. That the Television picture tube is returned at the sender's own risk and expense, adequately packed in the Manufacturer's standard packing (complete with internal fitments) for the type returned, and the Manufacturers accept no responsibility for loss or damage in transit or for the safe custody of any Television picture tubes returned to them. No claim will be entertained unless the tube is received with the glass bulb intact.
4. That the acceptance of any Television picture tube for examination and test does not imply any obligation on the part of the Manufacturer to replace or return it.
5. That if it is necessary to dismantle the tube for examination, the Manufacturers are at liberty to do so, without any obligation to replace or return it.
6. That claims under the Guarantee will not be considered unless the tube is returned to the Manufacturers accompanied by a Form of Application for Examination, obtained from and properly completed in conjunction with a Radio Dealer, preferably the one from whom the tube was purchased, supported by proof, if required, of the date of its purchase or delivery as replacement under Guarantee.
7. That the full List Price has been paid (except in the case of a replacement under Guarantee) and that the Manufacturer's identification or other marks have not been removed or defaced.
8. That no claim for tube replacement under the terms of the Guarantee will be entertained unless the returned tube is accompanied by Part B of the Guarantee Card duly stamped by Mullard-Australia Pty. Ltd. with the Registration date.
9. That Part B of the Guarantee Card has not been altered or defaced in any way.

N.B.—No person, firm or company has any authority to vary the conditions of this Guarantee.

Address all communications to:—

Mullard-Australia Pty. Ltd., Technical Service Department,
35-43 Clarence Street, Sydney, N.S.W.
Telephone: BX2006

Parts A and B of Card posted on 6TH. AUGUST 1956
(for user's convenience)

IMPORTANT—As this Guarantee becomes effective only if the Registration Card is duly received by Mullard-Australia Pty. Ltd., please ensure despatch immediately the tube is received. This Guarantee is not transferable.

Issued by
Mullard-Australia Pty. Limited — 35-43 Clarence Street, Sydney
592 Bourke Street, Melbourne.
Associated with Mullard Limited, London and Mullard Overseas Limited.

Mullard

A guarantee card accompanies each Mullard Radiant Screen Picture Tube whether it has been supplied as initial equipment in a new television receiver or as a cartoned tube for replacement purposes. The picture tube type and serial number should be endorsed in ink on the front of the card which is made up of three sections, parts A, B and C.

In order that we can offer the most effective service and courtesy to Mullard Radiant Screen Picture Tube owners, and indirectly to yourselves as the distributors, it is necessary that the following procedure be carried out.

It will be helpful if you assist the customer to fill out the guarantee card at the time of sale, i.e., installation of a new receiver in a customer's home, the fitting of a replacement tube during service or the sale of a tube to a home constructor. It is then the purchaser's responsibility to:

- ● *Remove part C (which he permanently retains, this part carries the picture tube type and serial number and also lists the conditions of guarantee).*
- ● *Fold parts A and B together.*
- ● *Affix a 4d. postage stamp.*
- ● *Mail so as to reach Mullard-Australia Pty. Limited within 10 days of the date of purchase.*

When received by our Technical Service Department, parts A and B are registered, part B is returned to the purchaser and part A is retained by us for record purposes.

In the event of a claim within the guarantee period, it is essential for the owner, with your assistance, to complete a "Form of Application for Examination" and return the picture tube, together with this form and part B of the guarantee card, to Mullard-Australia Pty. Limited, Sydney or Melbourne as applicable. (These forms are available through your normal supplier.)

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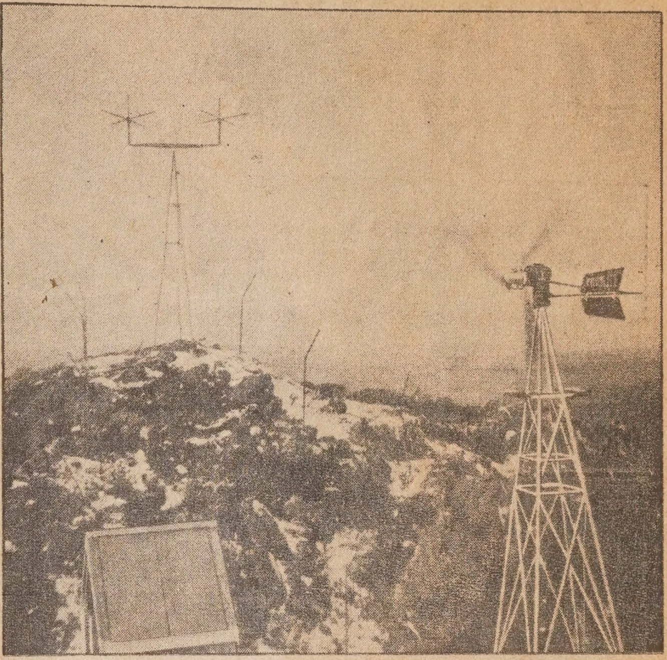
TASMANIA'S TALKING MOUNTAIN

A VOICE IN THE WILDERNESS THAT IS REALLY HEARD

At the top of Valentine's Peak, more than 4,000 ft. above sea level in the wild country of Tasmania, is one of Australia's strangest radio stations. It is completely unattended, and yet it provides the link from which conversations may be carried on over distances up to 160 miles. For weeks at a time it is almost inaccessible and its aerials covered with ice and snow.



The unattended VHF station upon Valentine's Peak in Tasmania, 4,000 ft. high. Wind-driven generators supply the power to operate it.

SOME time ago Associated Forest Holding Pty. Ltd., of Tasmania, was faced with the problem of communication between its vehicles which range through large tracts of forest.

Extensive logging operations are carried out in these forests, and the isolation of the men engaged in the work was a major problem in maintaining efficiency, and even the safety of those engaged in a rather hazardous occupation.

The use of mobile radio telephones in the normal way was an obvious answer, but because of the rugged terrain, and the distances involved, it was virtually impossible to obtain the required coverage without some special engineering to avoid the limitations of a simple system.

GOOD VHF SITE

Within reasonable range of the area concerned, Valentine's Peak towered as a tempting high spot for V.H.F. work. A station located there would command a very extensive area on a wide arc, but the prospects of installing and manning it in such a wild and inaccessible spot was out of the question.

Amalgamated Wireless (Australasia) Ltd. solved the problem by designing an unattended relay station which would operate all the year around from its own source of power.

It consists of two complete F.M. transmitter receivers of the type normally fitted to vehicles.

One of these equipments receives signals on a frequency of 80.46 Mc, and retransmits any such received signal on 76.94 Mc.

MESSAGE REPEATED

The receiver, which operates all the time the station is on the air, is interconnected with the transmitter in such a way that the latter is switched on only when a message is intercepted by the receiver.

This message is then rebroadcast by the transmitter, and is received by every other installation operating within the system. These installations have receivers tuned to 76.94 Mc and transmitters to 80.46 Mc.

Two separate aerials are used, one for transmitting and one for receiving, each fitted with a special filter to prevent mutual interference.

The range of the system is thus made independent of the normal car-to-car coverage. It is now virtually twice the range of a single car to Valentine's Peak, and messages have been passed over a distance of 160 miles.

BATTERY POWER

There is no A.C. power available at the Peak, and the equipment installed there is therefore battery operated. A wind-charging set makes use of the winds that blow almost continuously, and keeps the batteries up to voltage.

The second transmitter/receiver is used as a standby in case of failure, with automatic change-over facilities. Should the stand-by set by called into use, a warning signal is sent out to indicate that the change-over has been made.

A base station is provided as part of the system, and it can make contact with any vehicle through the relay. Normally the equipment at the Peak is switched on and off at set times, controlled by a time-clock, and operates from 6 a.m. to 6 p.m. The base station can extend the operating hours of the relay station by means of a special tone signal, but it cannot switch it on once the relay has closed down for the night.

The final 2,000ft climb to the Peak had to be travelled on foot, being too much even for a jeep. Even bags of cement had to be carried to the top. Often the station must operate for long periods without attention, as the mountain is frequently snowbound, and the aerials covered with ice.

It also has to withstand wind velocities of up to 120 m.p.h. as recordings have been made of winds blowing at that speed vertically up the steep sides of the peak.

More than 50 valves are used in the equipment, in addition to vibrators and spares.

TRANSISTOR SET

(Continued from page 7)

time zone dial and world time zone map; a phonograph jack that permits any record-player with a high output cartridge to be connected to the set's audio system; an earphone connection for "private listening" purposes; a dialite for night-time tuning, and separate volume and tone controls.

It is 10¼in high (including the handle), 12½in wide and 4 7-8in deep.

Probable retail price in the U.S. is 250 dollars, which includes batteries — eight for the set and one for the dialite.

AWA

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TYPE A56048
INDICATOR
OUTPUT
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SIG
AMALGAMATED WIRELESS (AUSTRALASIA) LTD. SYDNEY

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UNIVERSAL MEASURING BRIDGE

- Simplicity of operation.
- Magic eye indicator cannot be damaged by overload or wrong connections.
- Built-in self-checking system.
- Accuracy is unaffected by mains voltage variations.
- Open bridge position disconnects internal standards to allow use of external standards.

Price £30/10/- excluding Tax

IMMEDIATE DELIVERY

Resistance Range:
0.1 to 10M.

Capacitance Range:
10 $\mu\mu$F to 10 μF

Inductance Range:
Comparative measurements above 1mH.

Comparative Measurements:
Ratio 0.1 to 10.0 with switch on "EXT".
Ratio 0.8 to 1.25 with range switch on "%" (-20% to +25%).

Finish:
Case: †Twilight-blue dimenso.
Front Panel: Silver-grey dimenso.
Dimensions: 9" x 6⅜" x 4½."

For further particulars contact Test and Measuring Instruments Department

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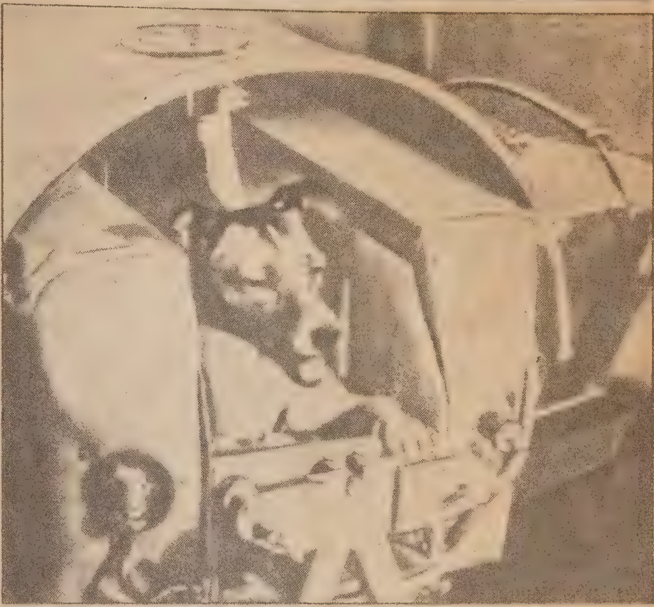
THE HAZARDS OF LIFE IN SPACE

The dog Laika, travelling in the second Soviet satellite, was exposed to nearly all the hazards which could confront a man planning an excursion into space. Its presence there would not have been required if the Soviet scientists were interested only in geophysics; the experiment is clear proof that they are serious when they talk of manned rocket flights.

By Nigel Colder


The space dog Loika—only living thing to have undertaken a space journey seen here in the Satellite in which it circled the earth. The containers at each side hold recording instruments. In front are food pellets and water.

IN America, too, Space Medicine is well-established as a new branch of physiology, and David Simons did not fly for 32 hours in a gondola this year merely to satisfy idle curiosity. He was studying the subjective impressions of high altitude and possibly (though rather improbably) the effects of cosmic rays on his body.

Survival in space depends first of all on survival of the cabin and its driving rockets.

The repeated failures of the relatively simple American long-range rockets show how disastrous shortcomings of the least significant parts may be. Add to this the complex firing procedure needed to get a manned rocket into space and back again, and it is reasonable that the would-be astronaut will be more concerned about mechanical failure than about the less tangible hazards which are the concern of space medicine.

He will also reflect upon the chances of catastrophic collision with a meteor when he has left the shield of the earth's atmosphere. Though meteors come in all shapes and sizes, and though some of them, the iron ones, are virtual armour-piercing bullets, calculations suggest that, with a reasonable thickness of skin (a few millimetres), the cabin should be punctured only once in about a hundred years.

METEOR SAND BLAST

Even if such a puncture did occur, swift action on the part of the space traveller might seal the hole before all the air escaped. Probably more dangerous is a flight lasting more than a few days in the "sand-blasting" effect of small meteors eating away the skin.

In fact, the most serious hazard to life is cosmic radiation. It is not one which will affect the success or failure of a short rocket flight, though it may very well cause permanent injury and earth death to the pioneers.

The primary cosmic rays are extremely energetic atoms, stripped of electrons and so positively-charged, travelling through space, from where we know not. We are protected from the primary rays by the air and only a gentle rain of mesons, gamma rays, electrons and other debris, reaches us at sea level. To provide equivalent protection, roughly the same mass of material would have to be placed between the occupants of a space vehicle and the primary rays—say, 30 feet of water or five feet of steel.

PRIMARY RADIATION

Most of the primary cosmic radiation consists of protons—charged hydrogen atoms. This is the most penetrating component. But it also includes many helium nuclei and, more rarely, heavier nuclei of many different sorts. The intensity of the cosmic ray bombardment in the neighbourhood of the earth is much greater near the magnetic poles than near the equator, because the charged particles spiral in towards them.

When they encounter other matter, the primary rays set off a very complex sequence of events. They collide with the nuclei of atoms and cause miniature explosions, followed by a process like radio-active decay. The primary fragments continue with great energy and set up "showers" of lighter particles. On a microscopic scale the total picture is spectacular — one primary produces countless secondary rays. On a human scale what matters is how much ionisation of molecules the rays cause in the living tissues.

The swifter the ray-particle, the less ionisation it causes in a given length of track, and a single iron nucleus can easily give rise to 1.000 times as much ionisation per millimetre of track as a proton. Radioactive-like disintegration after the impact of a primary particle on a nucelus produces low energy particles and rather dense ionisation.

Living matter can withstand repeated onslaughts at low ionisation densities much better than a single "saturating" event. The total dosage to be expected in space-flight even without shielding is possibly insufficient to cause appreciable damage to the human body as a whole, but the genetic effects will not be negligible and a nuclear disintegration in the body could cause severe localised damage. The space-traveller may well reckon his chances of suffering such a blow in the same way as he weighs up the hazards of meteors.

ALL OR NOTHING

Half-hearted attempts at shielding against cosmic rays would be more dangerous than no shielding at all. It would tend to slow the primaries down close to the energies at which they cause densest ionisation.

Before Laika's ascent recently the U.S. Air Force and others made a number of experiments with animals in balloons to test their vulnerability to cosmic rays. Thus, monkeys were exposed for a total of 63 hours 20 miles up to see if their irreplaceable nerve cells had been damaged—tests of their learning ability afterwards revealed nothing unusual. More positive were the observations on black mice, whose hair turned grey in patches owing to injury to the pigment cells.

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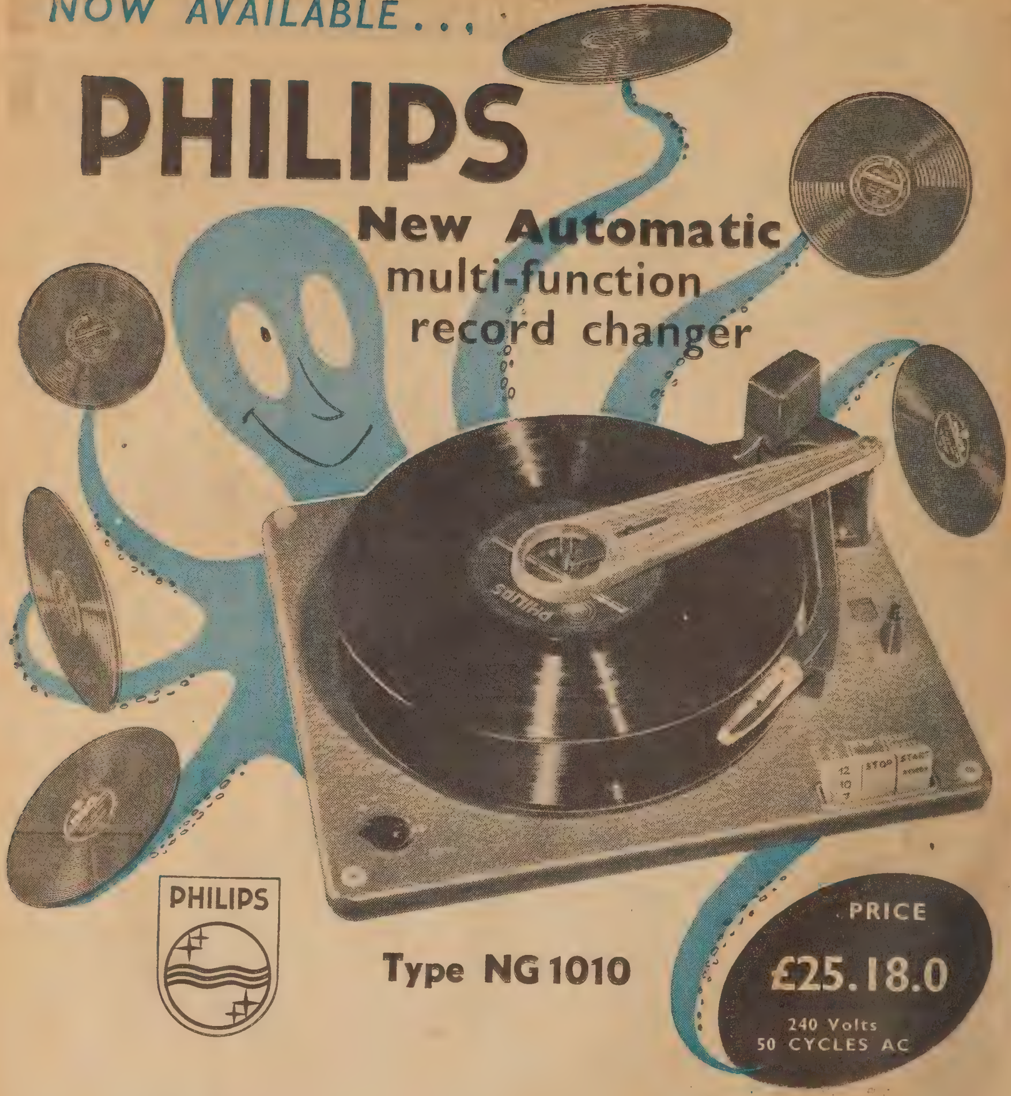
PHILIPS

New Automatic multi-function record changer



PHILIPS

Type NG 1010

PRICE

£25.18.0

240 Volts
50 CYCLES AC

The new NG1010 multi-function record changer combines a simple push button record changer with an automatic record player of completely new design. It incorporates the latest technical refinements for simplicity of operation and trouble-free service. The unit is attractively finished in Gold Hammerloid with burgundy tone arm. The turntable is flock sprayed and effectively cushions the records and so avoids damage. Completely automatic, just load up to 10 records (all sizes or a similar speed intermixed), press the start button and forget. The unit cuts off after the last record and, of course, mutes the pick-up during the change cycle. The loading arm lifts off for automatic single play operation, and the record can be placed directly on the turntable. Select the record size, push the start button and the arm is lowered safely and gently on the record with a precision not possible by hand. Push the stop button and the pick-up arm returns to its rest at the finish of the record and switches off.

- Automatic Record Changer, Automatic Player and Manual Player in one unit.
- Push Button operation — Simple and foolproof.
- Plays 7", 10", 12" records of same speed intermixed.
- Featherweight pick-up arm with detachable dual stylus, pick-up head — muting switch.
- All record speeds: 78, 45, 33 1-3, 16 2-3 r.p.m.
- No interfering rumble or wow.
- No record damage.

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A piece of mouse skin, exposed in a balloon and then regrafted on to the animal, developed a tumour. On the other hand, no genetic effect was observed in a thousand fruit flies exposed above the atmosphere, probably because the sample was too small.

Instrumental measurements of cosmic rays radioed from the satellite will give a wealth of important data about the physical potency of the cosmic rays. However, recovery of a mammal after several days in a satellite would be so useful in the estimation of the biological cosmic ray hazards to man that it must unquestionably form part of the Soviet program.

HUMANS LIKEWISE

But the reaction of the dog to the more obvious features of space travel is equally important. It survived the accelerations of launching and there is good reason to believe that humans would, too. Accelerations head-first of 4 g (four times faster than gravity) cause "greyout" and then "blackout" as the heart fails to pump blood to the head; feet-first, "redout" (due to excess blood in the head) occurs at 2-3 g.

At higher accelerations, death comes quickly. But while a sideways acceleration makes breathing troublesome, accelerations of up to 10 g could be withstood for short periods by a man lying crosswise in the rocket, and nothing greater need be experienced in space travel.

But a satellite in orbit falls freely toward the earth throughout its journey (why else does it pass from one side of the globe to the other?) and it stays "up" simply because of its high forward speed. In these conditions things have no weight because the weight of a thing is the force needed to prevent it falling.

Experiments on reactions to weightlessness have already been carried out, but for much shorter periods.

MUSCULAR TRAINING

Professor T. Lomonaca, in Rome, has subjected humans to "free fall" conditions in an apparatus like a lift, and he tested their muscular control by getting them to mark four quadrants of a circle with a pencil.

After suffering a little for the first few rides, the subjects grew accustomed to the sensation and improved their control over their muscles.

Similar evidence that weightlessness may not prove too serious has been provided by the U.S. Air Force's School of Aviation Medicine, where passengers in a Lockheed T-33A aircraft were flown for 10-30 seconds in dives or parabolas which simulated free fall. Drops of water floated around the cabin like down, and it took as much effort to lower the hand as to raise it.

A few passengers were very much put out, but half of them felt no discomfort and rather enjoyed the sensation.

All the same, grosser effects may have been masked by the shortness of the "falls"—the Americans bear in mind that it takes 15 minutes' rocking for the symptoms of seasickness to appear.

One can breathe and even eat standing on one's head, so these processes cannot be affected much by weightlessness. The heart's job should be easier.

Where the trouble is most likely to begin is in the organs of balance—particularly the otoliths inside the ears, which are the animal's "artificial horizon" and tell him which direction is "down." Experiments with both mice and turtles have shown that an animal robbed of the use of its otoliths and accustomed to doing without them, is much happier than normal animals in the weightless condition.

The otoliths may behave in one of two ways: they may give no indication of where "down" is, or else they may signal that "down" is in several directions at once.

The second possibility is clearly the more disturbing and it may be that individuals' otoliths react differently. Even so, signals from the satellite of the dog's general physical behaviour will provide the first report on sustained weightless flight.

Selection of spacemen will depend on much more than brains and physique. Perhaps the physiological tests will include some estimate of a candidate's vulnerability to ionising radiation as well as to hyper-acceleration and weightlessness.

But there is one more important fac-

(Continued on Page 112)

EFFECTS OF COSMIC RAYS IN SPACE

(after Dr. L. R. Shepherd)

Primary nuclei :	Relative abundance	Mean path before collision in iron (gm./sq.cm.)	Ionisation per 1/10 mm.	Relative biological effectiveness
Hydrogen	4,000	120	3	1
Helium	950	90	12—100	1
Carbon, Nitrogen, Oxygen ...	33	60	150—1,000	10
Others	10	37—50	600—100,000	30
Secondary rays :				
Early shower	—	—	3 & upwards	1
From smashed nuclei	—	—	400 & upwards	30

MINIATURE TV CAMERA FOR B.B.C.

A new type of TV camera made in France and used by the BBC. It has a power of .1 watts and a range of about 400 yards. An extra power supply boosts the power to 5 watt and the range to 2-3 miles. The actual transmitter and aerial are on the operator's back, weigh 40lbs, and make free use of transistors. Focusing is not critical and there is no electronic view-finder. Battery power is used.

There's More to Fish Than Fishing

by Calvin Walters

WHAT MAKES HIM FLOAT?—This earnest little lad, overcome with his new pet, wonders how he manages to stay suspended in the water without sinking to the bottom.

THERE have been so many exciting happenings in outer space during the past few weeks that we have almost forgotten that there is another exciting world in the opposite direction to which scientists are giving attention during the Geophysical Year. So this month we are "goin' fishing".

However, before we start I would like to say a few words regarding the Sputniks because I think that a lot of us have had our sense of perspective thrown out of gear. I refer of course to the controversy regarding the "little doggies in the sky."

Now I am a lover of animals to an almost fanatical degree, and I must admit that I had a funny feeling around the heart when my thoughts dwelt on the dog in Sputnik, way up 1,000 miles in the lonely sky.

Then I began to think that, after all, the matter bordered on the psychological, because if Sputnik was only revolving about a couple of hundred feet above the earth we wouldn't have felt so bad about it.

Then I came back to earth and my thoughts went back to the years I spent in a pathological laboratory where guinea pigs, rabbits, dogs, birds and so on were injected, had their nerves cut, became paralysed and were operated upon. I don't think the dog in Sputnik suffered so much as that, if at all.

Finally, I thought of all the lions, tigers and other animals that are confined in a living hell in small cages in circuses—kept there for no scientific purpose but just for the amusement of some of those who complained about Laika being Sputnik. The plight of these unfortunate animals could be relieved but nobody does anything about it.

Then again I am reminded of the interjector at a political meeting who asked the speaker "on what do you bias your opinion."

Now that I have had my say, "let's go fishin'."

There are funny things happening in the vast depths of the ocean. That area is a storehouse for some of the most curious and fantastic living creatures in all the realms of nature.

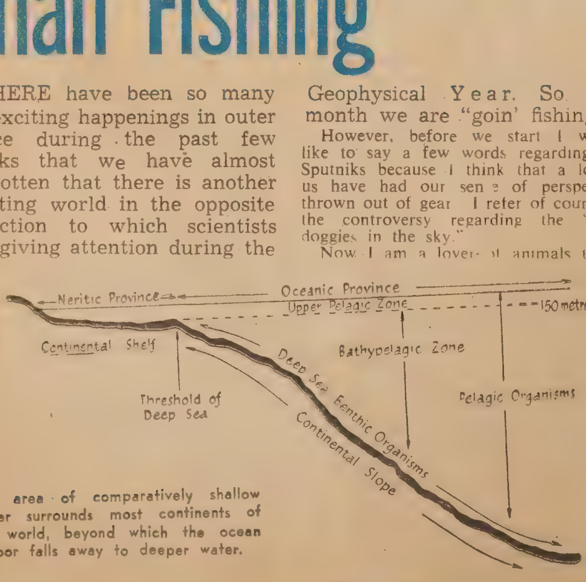
OCEAN PREDOMINATES

There are nearly two and a half square miles of ocean to every square mile of land. Everywhere the continents slope away from the beaches until depths of nearly seven miles of water is reached in some parts of the world.

From the beaches out to a depth of water of about 600 feet the sloping portion of continents is called the Continental Shelf.

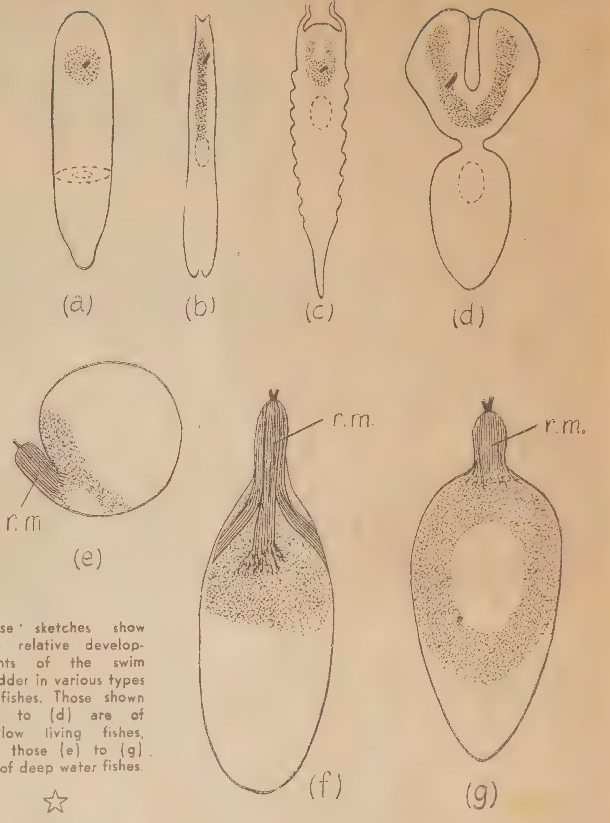
From this point the shelf lips sharply down to a depth of a mile or so. The sloping portion is called the Continental Slope. Beyond this are the waters of the Abyss.

Because the ocean is salty every fisherman usually has a demijohn of some sort of cordial in the boat to slake his thirst created by the salt spray getting into his mouth. In fact no fisherman is successful unless he has a demijohn in the boat.



An area of comparatively shallow water surrounds most continents of the world, beyond which the ocean floor falls away to deeper water.

SWIM BLADDERS MAKE FISH FLOAT



These sketches show the relative developments of the swim bladder in various types of fishes. Those shown (a) to (d) are of shallow living fishes, and those (e) to (g) are of deep water fishes.

The salts comprise those of practically every known element but it is mostly sodium chloride which, strangely enough, does not soak into the fish living in it and must be put on them after they are caught. The salts make up 3.3 to 3.5 per cent of the ocean water.

The temperature of the ocean water varies less than that of land water. The bottom of a fresh water lake never becomes colder than 39 degrees Fahrenheit because when water reaches this temperature it expands and rises.

It is true that, because of the salts contained in it, the deeper parts of the ocean can become colder than the deeper parts of fresh water oceans. Some parts of the deep ocean are below the freezing point of fresh water.

The great bulk of ocean water nevertheless is at a temperature of something less than 60 degrees Fahrenheit.

LOW TEMPERATURE

This fairly low temperature of the water has something to do with the supply of oxygen to the living creatures and plants in the ocean. Oxygen is contained to a greater extent in cold water than in warm. Therefore the surface water is well supplied with oxygen owing to the action of the waves mixing air with the water. This surface water is being constantly carried by currents toward the Poles where it becomes colder and sinks carrying the oxygen to the deeper parts of the ocean.

The pressure of water in the ocean varies considerably. On the surface of the earth everything is subjected to a pressure both inside and out, of 14.7 pounds per square inch. This is equal to the weight of a column of air one inch square and the height of the atmosphere (about 200 miles). This pressure equals 2,116 pounds per square foot. Thus every square foot of a man inside and out supports this weight but as the protoplasm of our cells is mainly water and as water is incompressible we are not affected by this pressure.

HIGH PRESSURES

When we consider the pressures in the ocean we get quite a different story. One has only to submerge to a depth of 33.2 feet to be subjected to the same pressure as the column of air 200 miles high. At a depth of 1,000 feet the pressure is 443 pounds per square foot or 32 tons per square foot. At the deepest part of the ocean the pressure is about 7.84 tons per square inch or 1,128 tons per square foot.

Because the creatures living in the ocean are adapted to the depths in which they live this pressure has no effect on them. Certain it is that if a fish is hooked a few hundred feet below the surface and rapidly brought to the top its eyes might bulge and its stomach protrude into its mouth, but if it is left in the water it will return to normal very quickly and adapt itself to the surface pressure. Provided a fish is brought to the surface slowly from any depth whatsoever, it will not be affected by pressure changes as it will adapt itself gradually to the varying pressures.

A sea animal does not require as much food as a land animal on a comparative basis notwithstanding that food for fish is contained in the sea in abundance.

The reason for this is that while a land animal is much heavier than the surrounding air and therefore must continually fight the force of gravity, sea animals are about the same weight as the water which surrounds them and therefore use less energy to propel themselves around than does a land animal.

Scientists have established that a man uses as much energy to raise his body one step on a stairway than he uses to take 12 steps on level ground. I have found this out myself. I definitely am not built to climb stairs.

On the other hand a shark swimming the same distance that a man walks on level ground uses much less energy than the man.

KEEPING AFLOAT

To overcome the force of gravity a fish needs very little to assist him. He may use his fins, or a system of fine waving hairs. The most popular method seems to be the float or swim bladder. This can be found in most fish of a bony type just below the backbone and kidneys. Sharks and rays have no swim bladder and therefore have to swim like mad to keep on top or they will sink to the bottom. There are other fish like sole and other flatties which have also lost the bladder and therefore live only on the bed of the ocean.

The swim bladder is a very interesting thing and bears some description.

It usually occupies about five per cent of the total volume of the fish and it has been proved mathematically that if a fish to remain in hydrostatic equilibrium with its surroundings the swim bladder should be what it is, namely about five per cent of the volume of the fish.

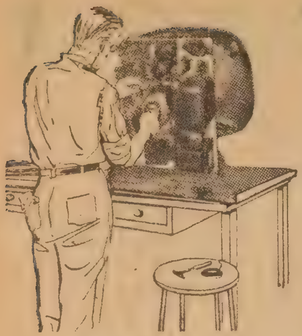
It's a funny thing about scientists. Nature provides something which behaves in a certain way, then some mathematician goes into a series of complicated calculations to prove that the thing is behaving exactly as it should do and nature was right after all.

The most popular type of swim bladders are those of the gaseous type which are filled with or depleted of gas at the will of the owner.

In these a large area of the inner surface of the bladder is covered with many layers of cells which form the gas gland.

This gland is supplied with blood by means of a network of arterial and venous capillaries which branch off certain arteries and veins which feed the bladder itself.

When a fish requires that its swim bladder be blown up its brain automatically sends an impulse which increases the blood supply to the gas gland. This becomes large and red with the blood



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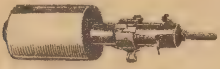

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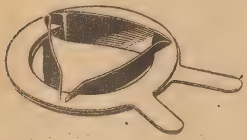
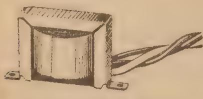
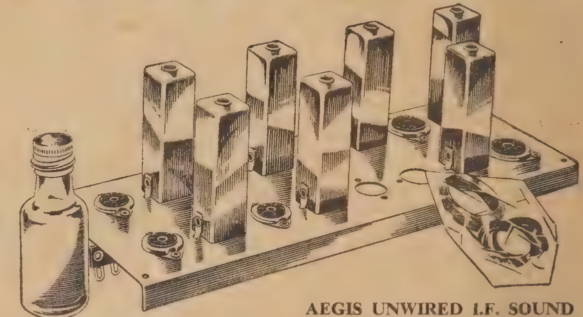


40405 Centring Magnet.



TVB1 40066 Vertical Blocking Oscillator Transformer.



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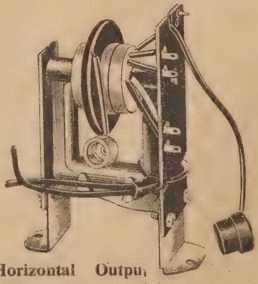

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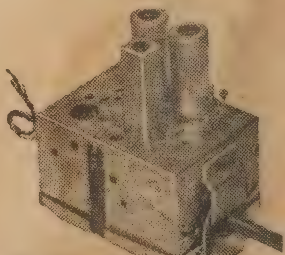

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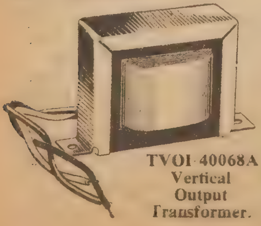

TVO1 40068A
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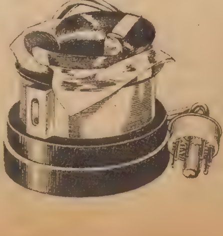
Output
Transformer.



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flow into the capillaries. Gas is then fed from the blood into the bladder, the gas being oxygen, carbon dioxide and nitrogen.

If the swim bladder happens to be in a collapsed state then the first gas to enter is rich with carbon dioxide and later enriched with oxygen.

When the fish requires that the pressure in the swim bladder be reduced a nervous impulse causes the gas to be reabsorbed into the blood through a special portion of the swim bladder which is covered by fine capillaries. It is interesting to note that only when the pressure of gas in the swim bladder exceeds the pressure of gas in the blood will it be re-absorbed.

SECRETES AIR

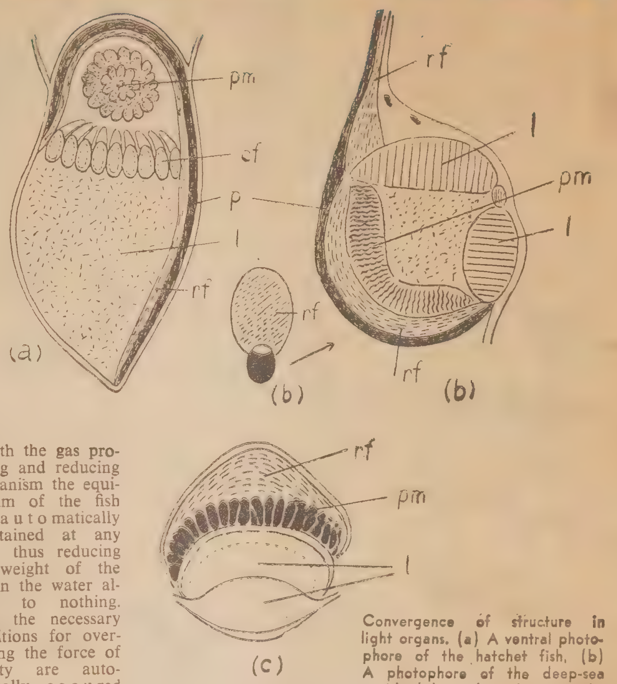
The perfect action of the gas bladder can be demonstrated by attaching a weight to a fish. It will at first sink to the bottom but in a very short while it will secrete more gas into the swim bladder. This adds to its body volume, it displaces more water, thus overcoming its increase in specific gravity and it rises again, provided the weighting has not been carried to extremes.

How convenient is this method of maintaining equilibrium is demonstrated in some of the deep-sea fishes which rise up and down in the sea for various reasons.

It is obvious that for a fish to float at any desired level a swim bladder entirely fixed in capacity would be useless. This can be explained by the fact that with such a fixed bladder the increased pressure of water as the fish swam downward would compress the bladder and reduce the buoyancy of the fish. On the other hand on an upward swim the reduced water pressure would allow the swim bladder to expand and the fish would find great difficulty in maintaining an even keel at a given level.

With the gas producing and reducing mechanism the equilibrium of the fish is automatically maintained at any level, thus reducing the weight of the fish in the water almost to nothing. Thus the necessary conditions for overcoming the force of gravity are automatically secured without conscious effort on the part of the fish and with the expenditure of little energy.

HOW FISH PRODUCE COLD LIGHT



Convergence of structure in light organs. (a) A ventral photophore of the hatchet fish, (b) A photophore of the deep-sea squid; (c) a photophore of the deep-sea prawn. Annotations:—p.m.—photogenic cell mass; p—pigment screen; r.f.—reflecting layer; l.—lens; s.f.—color filter.

The chemistry and physics of the phenomenon of luminescence which is present in some fish has been given considerable attention in recent years.

Luminescence is the production of light of a phosphorescent character and when present in animals or fish is called bioluminescence.

This quality exists in many organisms and is particularly well developed in the deep-sea fish, crustaceans and squids.

In tropical and sub-tropical seas the minute marine life such as plankton causes the sea to be a mass of light because of the bioluminescence of these creatures.

Special organs are provided in deep-sea fish to produce light. These organs are called photophores and are provided in numbers from one to dozens arranged in distinct patterns on the body of the fish.

Glandular cells inside the photophore may be the light producing agent, or in some cases the light may be produced by glandular cultures of bacteria which are in themselves luminous.

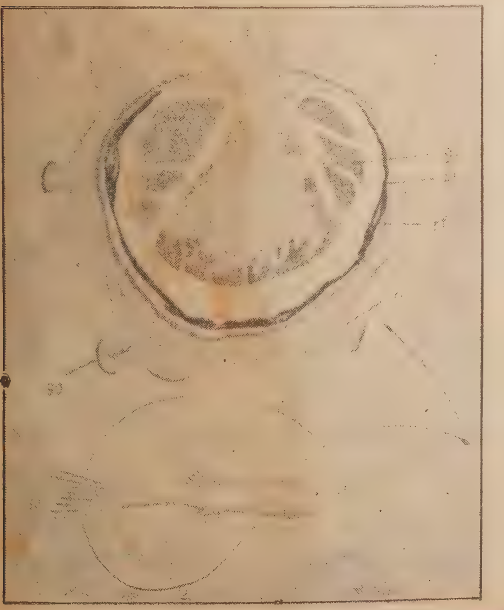
LIGHT SYSTEMS

Some of these light-producing organs are quite a complex arrangement with a lens like a projector. Others are provided with colour filters and some have adjustable diaphragms.

The light emitted by these organs is "cold light." That is, it is not produced by means of incandescence. Thus it is 100 per cent efficient inasmuch as no energy is wasted in producing heat.

Study of the chemistry of this cold light as given off by animals has revealed that it is due to the interaction of two substances, the first called Luciferin which seems to be a non-protein substance and the second Luciferase,

(Continued on page 23)



☆

Transverse section through the light lure of a fish. Annotation:— r.f.—reflecting layer; p.l.—pigment layer; s.o. sense organ; n.—nerve.

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Technical Review

MAGNETIC AMPLIFIERS USE ULTRA-FAST REACTORS

The move to miniaturization spreads to every branch of electronics, with obvious advantages, and many new developments include small size amongst their most desirable features. This article describes a small, ultra-fast saturable reactor, which has high reliability for industrial automation needs

THE demand for reliability in electronic equipment is constantly increasing. This demand has revived interest in one of the earliest practical amplifiers of electric signals—the magnetic amplifier.

One of the first models was built by the famous American radio pioneer, E. F. W. Alexanderson, over 40 years ago. By 1945 the magnetic amplifier had proven itself dependable by years of service in military and industrial control applications, but its usefulness was limited because of its long response time.

This slowness was due to the necessarily low "carrier" frequencies. The magnetic amplifier "carrier" is basically the same as the carrier used in radio broadcasting. A relatively high frequency wave is modulated by or "carries" the lower frequency "intelligence" or desired signal.

High core-material losses had precluded the use of high carrier frequencies. But now development of the new low loss, high-permeability, ferromagnetic alloys has made magnetic amplifiers practical for electronic circuits.

With the reduction of core losses, carrier frequencies up to 10 megacycles are possible. This gives magnetic amplifiers the fast response required in modern electronic instrumentation.

One of these new units is the "Ferristor" saturable reactor, made by the Berkeley Division of Beckman Instruments, Inc. It is a tiny device, not much larger than the eraser on a pencil. Technically it is a subminiature ultrafast saturable reactor.

The "Ferristor" reactor is very simple in construction. It has two solenoid-type windings on a magnetic core. The inner, or carrier-current, winding has a few hundred turns of very fine copper wire. The outer, or control, winding has from 1,000 to 4,000 turns, depending on its intended use.

The core is a few turns of sheet magnetic material, 1/8,000 of an inch thick, rolled into a scroll. The finished assembly is completely sealed by "potting" it in epoxy resin.

These units can be used in at least two fundamentally different ways, either as magnetic amplifiers or as bistable ferroresonant elements. The latter use requires only one winding, however.

When this reactor is used as a magnetic amplifier (Fig. 1), a small load capacitor is placed in series with the carrier winding. Changes in control current vary the core permeability.

This changes the effective inductance of the carrier winding. The carrier current is thus linearly modulated by the waveform of the control current.

The magnitude of the carrier current and the amplitude of the r.f. output (across the load capacitor) vary in step. The amplified input waveform is "recovered" by rectifying the output and filtering out the r.f.

DIODE POLARITY

The orientation of the rectifying diode determines whether the output is in or out-of-phase with the input. The unit amplifies because the carrier-current variations are much larger than the control current changes.

The extreme sensitivity of magnetic amplifiers enables them to amplify signals weaker than vacuum-tube shot noise.

The parts of a magnetic amplifier circuit may be compared to the parts of a vacuum-tube circuit. The control current corresponds to the control grid voltage; the carrier supply compares to the "B plus" supply; the carrier current is analogous to the plate current; and the load impedance corresponds to the plate load.

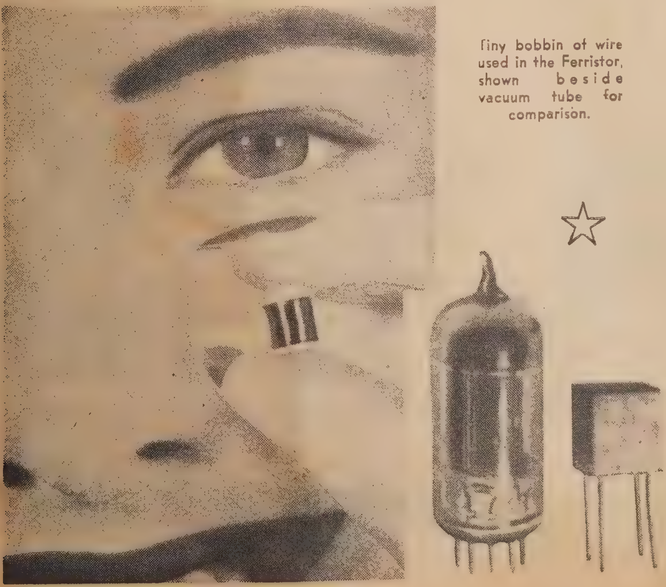
The other basic application of "Ferristor" reactors employs the phenomenon of ferroresonance to produce a bi-stable characteristic they can maintain either of two possible stable states indefinitely.

In ferroresonant operation a capacitor is selected to resonate with the partially saturated carrier winding inductance near the applied frequency.

The resulting circuit has an S-shaped curve of voltage versus current. See Fig. 2. The capacitive reactance is constant with increasing current.

But when the current through the iron-cored carrier winding is increased it becomes saturated. This decreases its effective inductance and the inductive reactance of the circuit.

Over a limited range, either of two different stable values of current can exist.



Tiny bobbin of wire used in the Ferristor, shown beside vacuum tube for comparison.

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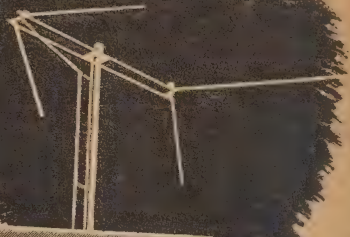

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for one given voltage. In circuit operation this voltage is actually the r.f. supply voltage.

The intersections of the curves of power supply output and positive-slope circuit impedance are the two stable states. In the low current, or non-saturated state, the circuit is inductively reactive. In the high current, or saturated, state it is capacitively reactive.

In ferroresonant operation the control current does not flow constantly. Instead trigger pulses of control current are used to induce partial saturation of the core. It can be saturated by an external magnetic field, by d.c. in the control winding, or by r.f. in the carrier winding (which makes it capable of self-saturation).

A d.c. trigger pulse is applied through the control winding to raise the carrier current to the high state.

TRIGGER PULSE

The trigger pulse can be of either polarity, since both will temporarily reduce inductance. To make it change states, the core must be partially saturated to the point where any current increase decreases the inductance enough to drop the output voltage.

Thus a pulse causes the current to regeneratively jump to the stable high current point. The interdependence of low inductance and high current keeps the circuit latched in this state of self-saturation. The unit cannot return to the low-current state until its supply voltage is reduced below the level where self-saturating current flow starts.

A ferroresonant flip-flop can be constructed by running two reactors in parallel. They must have a common coupling element—capacitor or triggering reactor—to the r.f. supply voltage. If memory and gating circuitry are added, the flip-flop can be operated with a single input.

An extended version of the flip-flop is the ring counter, Fig. 3, composed of several reactors operated in a closed loop. The ring counters are connected to the supply voltage through a common coupling element.

Its value is chosen so only one unit at a time can draw high current. If two or more try to jump high, the extra current through the common coupling tends to drop the voltage so neither can be high.

LARGEST CURRENT

The action in a ring counter is not random. In one common circuit, each unit has a directive circuit to transfer the high current or "active" state from one stage to the next stage in turn with each successive input pulse.

The varistor associated with the "active" unit has the largest current through it. Thus it will conduct the most when the ring is pulsed. This increased current also flows in the control winding of the unit following.

The new unit then goes into the high current state and the previous unit is forced out because of the action of the common coupling element.

The action of the stages in a ring counter may be compared with several glow regulator tubes in parallel across some voltage through a common resistor.

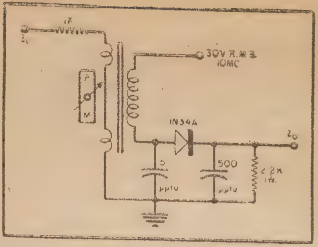


Fig. 1. Basic magnetic amplifier. Permanent magnet used to provide biasing effect.

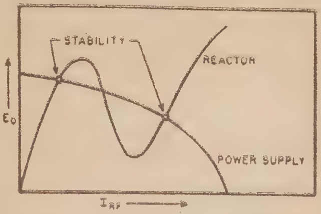


Fig. 2. Curves of ferroresonant operation.

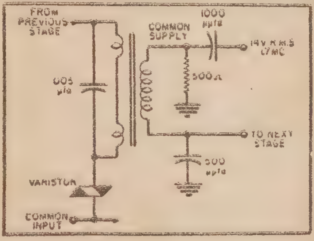


Fig. 3. Typical ring counter stage. The varistor is used for circuit stability.

As the voltage is raised, one tube will strike first, lowering the voltage to its regulated value. This prevents the other tubes from firing since the voltage has been reduced below their firing potential.

These units can be used in a one-shot multivibrator circuit. See Fig. 4 This circuit generates a constant-width output pulse and steepens the leading and trailing edges of a slow pulse input.

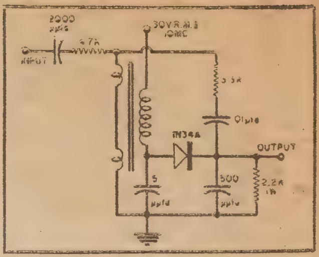


Fig. 4. Typical one-shot multivibrator.

The one-shot circuit is made from the magnetic amplifier circuit by adding a capacitor and resistor in series from the output to the input. The diode is oriented for in-phase output. The output pulse width is determined by the discharge time of the resistor and capacitor.

The circuit is triggered by an input pulse which induces partial saturation. Regeneration causes the carrier current to jump to the fully saturated state.

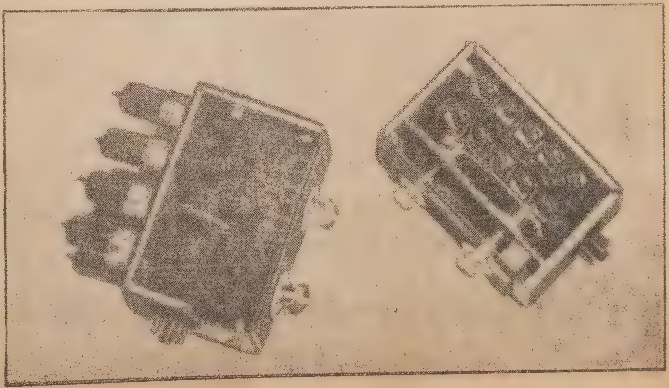
A change at the output is reflected back to the input where it adds to the original input signal. This additive action takes the output practically instantaneously to its saturated value, where no further change is possible.

BIAS CONTROL

While current from the capacitor keeps the core saturated the output stays in the high state. But as soon as the charge leaks off, the output drops back to the low state. This circuit can put out 25-volt, 4-microsecond pulses into a 1,000-ohm load.

This can be altered with bias changes. Bias can also be used to cause the circuit to trigger at a particular point on the input wave. The circuit shown requires a 15-volt positive pulse drive and puts out a pulse 40-microseconds wide.

A current discriminator, Fig. 5, which generates rapidly changing waveforms from slowly varying input waveforms, can also be made from these reactors. It is the analogue of the familiar vacu-



Ferristorized decimal counting unit (right) compared with the vacuum-tube version.

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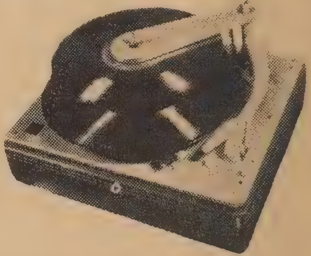

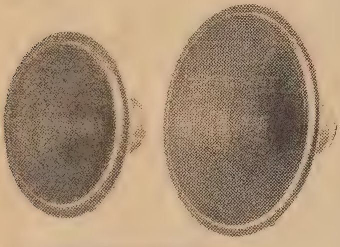

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um-tube voltage discriminator, or the Schmitt trigger circuit.

To form this circuit positive feed-back is added to a magnetic amplifier through a series resistor from the output to the input. The diode rectifier is oriented for in-phase output. The discriminator has two possible stable states, either high- or low-current output.

When the input current is above a certain value the output will be saturated. When the input current is below another certain value the output current is low and non-saturated. The circuit "hysteresis" is the difference between these two input current values.

The magnitude of the "hysteresis" depends on the size of the feedback resistance. When the value of input current is within the range of these values the output state depends on whether the input was previously above or below the "hysteresis" range. The change of state is caused by regeneration. In the circuit shown the "hysteresis" is 130 microamperes.

PULSE GATE

The current discriminator may also be used as a pulse gate. A d.c. bias fixes the static level of the control current without input pulses. If the d.c. level is high the gate is "open" because input pulses can reach the region of partial saturation to produce output pulses. If the d.c. level is low the gate is "closed."

"Ferristor" reactors are very versatile. They can be used in many circuits including oscillators, multivibrators, discriminators, balanced or differential amplifiers, coincidence gates, ring counters, binary counters, stepping registers, and many others.

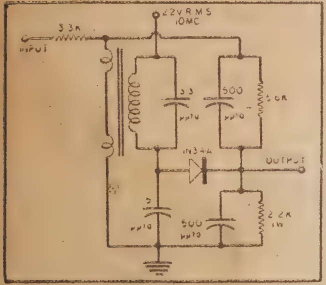


Fig. 5. Circuit of current discriminator.

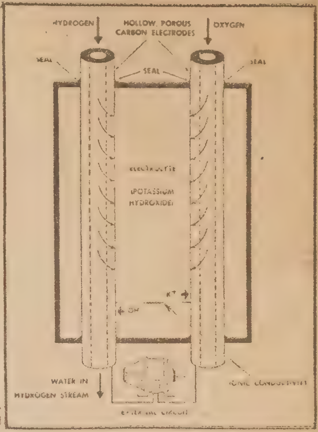
These reactors are almost completely unaffected by shock, vibration, temperature, humidity, altitude, time and the other things affecting vacuum tubes. They are reactive rather than dissipative devices so they generate little heat and there is practically no power waste. For these reasons they should last almost indefinitely.

The invention of the audion displaced the original magnetic amplifier from favour. But now its modern descendant — the "Ferristor" reactor — with its greater inherent ruggedness may replace the relatively short-lived vacuum tube for certain applications requiring good reliability.

CELL PRODUCES FUEL FROM GASES

FIRST PRACTICAL CONVERSION OF CHEMICAL ENERGY OF GASES

DIRECT conversion of the chemical energy of gases into electricity has been accomplished with the development by National Carbon Co. of the first practical fuel cell. A single fuel cell unit consists of nine hollow, porous carbon electrodes grouped in a round plastic housing. A carbon header on each end channels hydrogen and oxygen gases into the proper electrodes, and electrical connections conduct away the power. The cell is filled with a solution of potassium hydroxide, which serves as the electrolyte. The voltage produced across the electrodes of the new fuel cell is about 1 volt, although fairly high currents may be delivered



Simplified drawing shows basic operation.

MORE TO FISH THAN FISHING

(Continued from Page 17)

which has protein-like properties. This latter is an enzyme and interaction of the two substances produces oxidation of the luciferin. In the reaction Luciferin plus oxygen equals oxyluciferin plus water plus light.

There seems to be a variation in this chemical set-up according to the animal. For instance the Luciferin from one animal mixed with luciferase from another with not always provide a reaction to produce light.

There is a crustacean called Cypridina whose luminescence has been the subject of a good deal of study. This is a handy sort of shellfish for it can easily be found in sand and can be dried and thus kept for long periods of time.

There is a story fairly well authenticated by Professor Newton Harvey that the Japanese used the powder from Cypridina for reading messages during World War II. Where it was not possible to use a lamp when in close proximity with the enemy, the Japanese would moisten a small quantity of the Cypridina powder and read the message by the resulting low intensity light.

CHEMICAL LIGHT

A mixture of the two chemicals in the presence of oxygen produces a bright flash of light for a few moments.

In some fish there is an extraordinary arrangement of a rod with a line, which dangles some distance in front of the mouth of the fish with a luminous organ suspended from the end of the line. This is obviously used as a lure to attract other animals on which the fisherman fish feeds. In some cases the inside of the mouth is lined with photophores and with the mouth held wide open with the luminous bait dangling in front, a fairyland of light attracts the prey right into the mouth of the angler fish.

Because of the arrangement of photophores along the sides of the body and head of some fish, there is no doubt that considerable illumination is spread around the water during the presence of the fish. Furthermore, the emission of light seems to be completely controlled and the fish is able to turn the light off and on at will.

The purpose of these lights seems to be not only to lure prey but to light the visual field of the fish.

The light organs of all fish are well supplied with blood vessels, while some have nerves running to them and others have not. It is thought that control of the light in some fish is brought about by hormones injected into the blood stream. It has been established that an injection of adrenaline into the blood stream of a fish will cause the fish to switch the lights on.

RECOGNITION

It is also certain that the definite pattern of the arrangement of the photophores along the sides of the body and the face acts as a sign by which certain species can recognise each other.

There is a type of squid which has the capacity to pour out a thick secretion which becomes luminous when in contact with sea water and fills the surrounding water with a cloud of sparks. This, it is thought, is another way among the many of escaping from an enemy. There could be nothing more confusing to an enemy than to be blinded by a cloud of glaring lights.

Pictures illustrating this article show some of the fantastic arrangements of lights possessed by some fish.

Yes, there are many strange things in the sea. Perhaps there is more to discover in this living world of wonders than on any far-off planet, which may be nothing more than a lump of dead earth. During the Geophysical Year much will be done to explain the wonders of the living ocean.

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Postage: Vic. 1/10; Int. 3/

MODEL TK-70

Size: 5in x 3½in x 1¼in.
Model TK-70 is a pocket size rotary switch type circuit tester with an insulated panel and steel cabinet.
D.C. Volts: 10/50/250/500/1000V (2000 ohm/V)
A.C. Volts: 10/50/250/500/1000V (2000 ohm/V)
D.C. Current: 500uA/25/500mA.
Resistance: 10K ohm/1mg. ohm (by 3V internal battery).
Decibels: —20 to +22 db
+20 to +36 db
Price: £12/15/.
Postage Vic., 1/10; Int., 3/

MODEL TK-90

Size 6in x 4in x 2¾in.
Model TK-90 is a handy size rotary switch type circuit tester with a black bakelite panel and cabinet, having a high sensitivity 45 uA meter 20,000 ohms per volt on D.C and 8,000 ohms per volt on A.C.
D.C Volts 10/50 250 500 1000V (20,000 ohms/V)
A.C. Volts 10/50/250/500/1000V (8,000 ohm/V)
D.C. Current: 50uA/2.5/25/250 mA.
Resistance: 5/50/500 K. ohm/5megohm (By 3V internal battery)
Decibels: —20 to +5db.
(0db — .0775V — 600 ohm)
+5 to +22db.
Price £15/15/. Postage Vic. 1/10; Int. 3/

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Front Loading Bezels—take M.E.S. Lamps OPAL-RED-GREEN-AMBER	6/8	ea.	6d	6d
Headphones — Imported Hi-Impedance	37/	pr.	1/	1/
3XA Crystal Microphone	48/7	ea	1/	1/
Microphone Stand Desk Type 4in	14/11	ea.	1/10	3/
Microphone Stand Desk Type 9in	16/10	ea	1/10	3/
Wire Wound Potentiometers 6 ohms to 10,000 ohms	11/9	ea	10d	10d
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9 pin Min. Sockets w/shield — mica filled	3/10	ea.	10d.	10d
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EMPTY TAPE SPOOLS 3in metal	8/	ea.	10d	10d.
3in plastic	9/	ea.	10d	10d
5in plastic	7/	ea.	10d	10d
7in plastic	10/	ea.	10d.	10d.
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WAFER SWITCHES — SINGLE BANK 1 x 12 — 2 x 4 — 2 x 5 — 2 x 6 — 3 x 3 — 4 x 2 — 4 x 3	11/6		6d	6d

		Postage Vic.	Postage Int
PICTURE TUBES 17in — 17HP-4B	£30/14/	Freight	Forwar
17in — MW43-69	£30/10/	"	"
21in — AW53-80	£41/ /	"	"
Philips turret Tuner	£18/5/	2/3	3/8
A.W.A. Raster Components	£12/13/2	3/8	6/
Q Plus I.F. Strip Mark I	£27/2/6	1/10	3/
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Separate I.F. Transformers: VIF 2, 3, 4, 5, 6	19/3 ea.	4d.	4d
VIF 7	13/9 ea.	4d	4d
VIF 8	24/9 ea.	4d.	4d.
BIB Wire Strippers	6/3 ea.	4d	4d
SPINTITES 1/8in, 5/32in, 3/16in	9/7 ea.	4d	4d
SCOPE VIBROSCOPE — Writes on metal from battery or transfomer	33/	1/6	2/6
VESTA Min. Hydrometer — A quick and easy tester for your car battery	7/6 ea.	6d.	6d.
ENAMEL WIRE—4 oz. Reels 20 B and S	9/6 ea.	6d	6d.
22 B and S	9/6 ea.	6d.	6d
24 B and S	9/6 ea.	6d.	6d.
26 B and S	11/7 ea.	6d	6d
28 B and S	11/7 ea.	6d	6d
30 B and S	16/ ea	6d	6d
33 B and S	16/ ea	6d.	6d
AERIAL WIRE — Covered — 100ft coil	6/10 ea	1/10	3/
EGG INSULATORS	8d. ea.	2d.	3d

SPECIAL

			Postage Vic.	Postage Int
Min. IF Transformers 455 K.C.	13/11	ea.	6d.	6d.
Min. B/C Aerial Coils	9/9	ea.	6d.	6d.
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Min. 455 K.C. Oscillator Coils	9/9	ea.	6d.	6d.
Power Transformers 40 m.A. 240V a side	35/	ea.	3/9	6/
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80 m.A. 385V a side	59/6	ea.	3/9	6/

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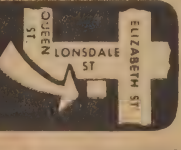

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NEWS AND VIEWS OF THE MONTH

Englishmen and Sputnik

WHAT do Englishmen think of Sputnik? Well, this is the reaction of "Geminus," who writes a page of commentary in "The New Scientist."

"By now it should be apparent that I think Sputniks are excellent things which ought to be encouraged. However, I wish someone would explain to me what they are for. Obviously the Russians believe in them quite deeply, while the Americans are teetering on the edge of frenzy because they do not yet have one to call their own. But what—I nearly put 'What on earth' — are Sputniks for?

"It all boils down, I think, to a question something like 'What good would be a picture of the other side of the Moon?' Several answers to this kind of question are, of course, possible.

"A Treasury official would no doubt say, 'How much would it cost?' and on being told would lose interest in such an extravagant notion.

"Prime Ministers and State Departments clearly think on different lines. A Sputnik has been discovered in the last few weeks to be a fine carrot to dangle in front of uncommitted countries, and a powerful fortification of one's allies' courage. So a photograph of the back of the Moon might be expected to be a thing worth brandishing about. Political reputations might even be saved, anxious politicians may think.

"Then, of course, there is the small boy's answer. 'We must conquer space.' We must put the Union Jack in whatever mud covers the surface of Venus or our heads will not be worth lifting up in this heroic age.

"More seriously, there is the scientific answer. 'It would be good to know whether the other side of the Moon really does look like the one that is pointed toward us.' By a study of the ranges of mountain ridges that radiate out from craters on this side of the Moon, it is possible to be fairly certain that there must be a very close resemblance between the two faces, but nobody is quite sure. So people would like a photograph and even the most complete sceptic would not deny that this would be a contribution to pure science.

"So the question becomes that of deciding whether such a contribution to humanity's precious store of knowledge would be worth having. I would like to know who thinks himself in a position to answer such a question. He should be warned that it is like replying to the question: Was Shakespeare worthwhile?"

Driverless Taxis

EVERY morning sees 250 new cars on the Paris streets, making the traffic problem daily more difficult to solve.

An ingenious suggestion has been put forward by M Antoine Martin, engineer. He proposes a service of taxis without drivers.

Before being able to start up the engine of one of these taxis, the driver-passenger would have to put a disc in a slot. These discs he would buy at various special offices after giving his name and address and showing his driving licence. Every disc would have its own number, making tracing of the passenger easy in case of need.

No one would be allowed to park such a taxi, so that immediately it was left by one fare another could use it. Each taxi would be provided with a limited amount of petrol to guard against abusive use, and special survey trucks would circulate to refuel taxis or remove them should too many be left in one spot.

The principal advantage foreseen is that car owners would prefer to use these taxis within the city, which would eliminate the large number of cars parked for long hours, and a single taxi could serve in turn a score of fares, hence one taxi instead of 20 separate cars on the streets.

"OLD SOL" SETS A RECORD

Insofar as the value of the International Geophysical Year depends on a plentiful supply of sunspots, it should be a resounding success. In October last the sun beat all previous records of sunspot activity and provided astronomers with a "sunspot number" greater than any that has turned up since systematic records were first kept in 1749.

At the time of writing there is not enough information to tell whether November will outdo the October figure, but it is more than likely that the peak of sunspot activity has now been passed, and that the frequency of spots on the surface of the sun will decline rapidly during the next two or three years.

The present sunspot records will go some way to confirm conclusions which have been arrived at by the study of old sunspot numbers. For one thing, the present maximum has followed the last after an interval of little more than 10 years. This is considerably less than the average length of the sunspot cycle, which appears to be about 11.1 years. It has, however, been recognised that the more intense maxima are associated with comparatively short periods.

Another interesting feature is that two successive maxima, those of 1947 and 1957, should have given abnormal displays. This offers confirmation of the belief that sunspot cycles go together in pairs—or that the true periodicity of the sun's activity is 22 years involving two maxima and two minima.

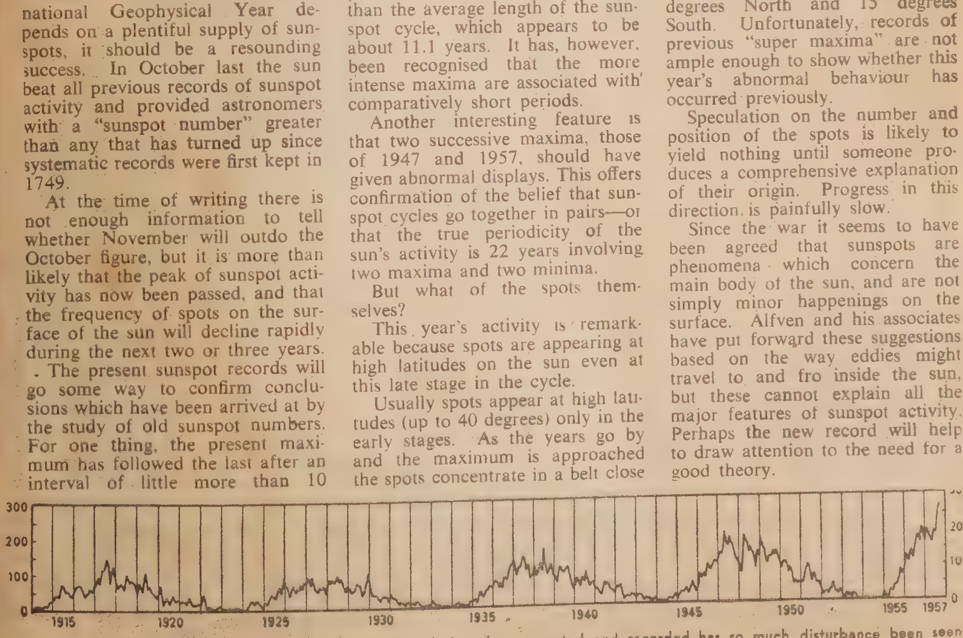
But what of the spots themselves?

This year's activity is remarkable because spots are appearing at high latitudes on the sun even at this late stage in the cycle.

Usually spots appear at high latitudes (up to 40 degrees) only in the early stages. As the years go by and the maximum is approached the spots concentrate in a belt close to the equator within latitudes 15 degrees North and 15 degrees South. Unfortunately, records of previous "super maxima" are not ample enough to show whether this year's abnormal behaviour has occurred previously.

Speculation on the number and position of the spots is likely to yield nothing until someone produces a comprehensive explanation of their origin. Progress in this direction is painfully slow.

Since the war it seems to have been agreed that sunspots are phenomena which concern the main body of the sun, and are not simply minor happenings on the surface. Alfven and his associates have put forward these suggestions based on the way eddies might travel to and fro inside the sun, but these cannot explain all the major features of sunspot activity. Perhaps the new record will help to draw attention to the need for a good theory.



Never in the 200 years in which dark spots on the Sun's face been counted and recorded has so much disturbance been seen as at the present.

PHILIPS *Microphones*

EL 6040

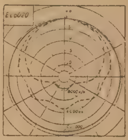
EL 6020 AND EL 6040

These non-directional and very reliable electro-dynamic microphones are ideally suitable for:

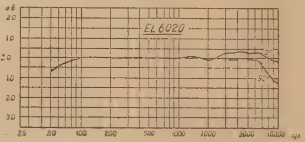
★ TV ★ Broadcasting ★ Sound Recording
★ High-quality public address systems

This table gives the output voltages, measured across open terminals and at a sound pressure of 1μ bar and 1,000 c/s.

Impedances	Output Voltages	
	in mV	in db with respect to 1 V
10,000 Ω	1.25	–58
500 Ω	0.25	–72
50 Ω	0.08	–82



Directional effect. Output voltage measured at various angles of the incident sound and expressed in decibels with respect to the voltage at 1,000 c/s and sound striking the microphone in the axial direction.



requency response curve.
utput voltage for sounds of arious frequencies striking the microphone under an angle of 0° and of 90°, expressed in decibels with respect to the output voltage at 1,000 c/s.

Diameter .... $2\frac{9}{16}$ in.
Max. Inclination .... 60°
Height Above Stand .... 7 in.
Net Weight .... 1 lb. 11 oz.

PHILIPS

Owing to the very small diameter, the quality of reproduction is practically independent of the angle of sound incidence (see response curve).

The frequency response is independent of the speaking distance. The distortion is as low as that of a good condenser microphone.

The self-noise of the microphone lies only 15 db above the threshold of audibility (10/16 W/sq. cm.); the wind noise level is very low.

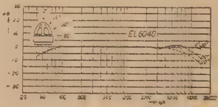
The table below gives the output voltages, measured across open terminals and at a sound pressure of 1μ bar at 1,000 c/s.

Impedance	Output Voltages in db with respect to	
	In mV	1 V
25,000 Ω	1.5	–56.5
500 Ω	0.22	–73
50 Ω	0.07	–83

At a sound pressure of 1 newton/sq. m. the output voltages are ten times the values given above, and the level is 20 db higher than indicated for a sound pressure of 1μ bar.

The real input impedance of the amplifier should preferably be at least three times the microphone impedance; when it is less—but not less than the microphone impedance—the sensitivity will diminish, but this will not affect the quality of reproduction.

Max. diameter: $1\frac{1}{16}$" (27 mm.).
Overall length: $10\frac{5}{8}$" (270 mm.).
Max. inclination: 60°.
Net wt. without cable: 12 oz.
Net wt. with cable and plugs: 1 lb. 5 o
Frequency response curve.
Output voltage for sounds of various frequencies and angles of incidence, expressed in decibels with respect to the output voltage at 1,000 c/s.



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VHF in Scotland

THE B.B.C.'s new very high frequency sound broadcasting station, which has been carrying out test transmissions since November 15, was scheduled to open on November 30. It will radiate the Scottish Home Service on 94.3 Mc/s, the Light Program on 89.9 Mc/s, and the Third Program and Network Three on 92.1 Mc/s.

The station has an effective radiated power of 120 K.W., and as at other B.B.C. V.H.F. sound broadcasting stations, the transmissions are horizontally polarised.

The new station will serve about four million people in an area which includes the counties of Renfrew, Stirling, Clackmannan, Fife, Kinross, Peebles, Midlothian, East and West Lothian, most of Lanarkshire and Dunbartonshire, the northern half of Ayrshire, the southern parts of Perthshire and Angus, and a substantial part of Berwickshire.

Listeners within this area who provide themselves with suitable receivers and where necessary with suitable external aerials will find that V.H.F. transmissions are much less susceptible to interference from foreign stations and from electrical apparatus than the long-wave and medium-wave transmissions, and that they are capable of giving much better sound quality.

Together with the population already served by the B.B.C. V.H.F. station at Meldrum, near Aberdeen, the B.B.C.'s V.H.F. sound broadcasting service will, with the opening of Kirk o' Shotts, become available to over 80 per cent of the population of Scotland. A third V.H.F. station for Scotland, at Rosemarkie, near Inverness, is planned for completion in the spring of 1958.

* * *

More BBC Colour TV

THE B.B.C. started a further series of experimental colour television transmissions in October. These are a continuation of the experiments which are being carried out by the B.B.C. for the purpose of studying the problems of producing, transmitting, and receiving television pictures in colour. The experiments have included transmissions from the B.B.C.'s London television station, the first of which was in October, 1955.

This new series of experimental transmissions, which will take place outside normal program times and continue for about six months, will be transmitted from the B.B.C.'s London television station at Crystal Palace in south London, and material will include studio production, films and slides from a colour television studio and control room which the B.B.C. has specially equipped for the purpose at Alexandra Palace in north London.

These experimental transmissions are being made in co-operation with the British radio industry, and in agreement with the Television Advisory Committee, which has been asked by Britain's Postmaster-General to report on the whole field of colour television.

They do not commit the B.B.C. to the adoption of the system of transmission used for the experiments or of any other system of colour television.

The decision whether or not to introduce a Public Service of colour television, the starting date, and the system to be adopted rests with the Postmaster-General.

WANTED

Radio Officers and Traffic Assistants

for the

OVERSEAS TELECOMMUNICATIONS COMMISSION (AUSTRALIA)

The Overseas Telecommunications Commission operates Australia's overseas communications services through two main telegraph offices, five cable stations and six international radio stations, in addition to the Coastal Radio Service through 23 stations around the coast of Australia and in Papua/New Guinea.

TRAFFIC ASSISTANTS

Vacancies exist for young men up to 19 years of age with the Intermediate Certificate as Traffic Assistants in the Commission's telecommunications centre at Sydney.

Initial duties include recording, sorting and distribution of telegraphic traffic at a commencing salary of £364 per annum for those under 18, rising with age and experience to £822 per anum while earlier higher salary ranges may be attained by qualifying as Telegraphist, Radio Officer or Radio Technician.

These are permanent positions with free or assisted training facilities and Commonwealth Superannuation

RADIO OFFICERS

Vacancies exist in the Commission's Coastal Radio Service for holders of a First or Second Class Commercial Operators' Certificate of Proficiency in Radiotelegraphy and Radio-telephony who are capable touch typists.

Successful applicants who are medically fit have the opportunity to serve at stations situated in all capital cities and at other places around the coast of Australia and in Papua/New Guinea.

The salary range is £912-£1092 for holders of First-Class Ticket or £882-£1062 for persons with Second-Class Ticket. Shift work is involved for which extra payments are made, while other allowances are payable at tropical and remote stations up to a maximum of £320 per annum for a married officer stationed in Papua/New Guinea or at Darwin.

Hours of duty are 36 per week, while annual leave accrues at the rate of from 15 days per annum at southern locations up to a maximum of 30 days per annum at certain northern stations.

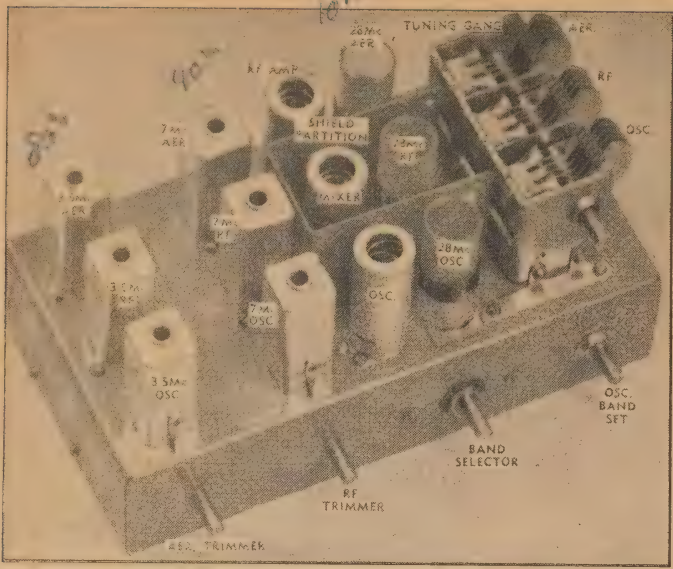
Furnished staff cottages at a moderate rental are available at most non-metropolitan locations.

Early permanent appointment which carries right of entry into the Commonwealth Superannuation Fund is available.

APPLY TO:

The Chief Administrative Officer,
Overseas Telecommunications Commission (Australia),
Box 7000, G.P.O., Sydney.
or ring B0544, extension 259, and arrange for an interview.

OTC



A top view of the Bandspread unit, built in compact form to fit the chassis of the Short-Wave Seven receiver, as originally described in March 1949. It obviates the need for plug-in coils yet does not call for critical adjustments.

Bandspread Tuner For "Ham" Receivers

Perhaps you own an old-fashioned receiver and are heartily sick of plugging in coils to change bands. Or, yet again, you may be casting around for a high-performance yet not-too-critical front end for a new set. Either way, this tuner may be just what you're looking for.

by Maurice Findlay

THROUGH all the years that "Ham" radio has been what it is, the design of a "front end" for amateur receivers has remained as one of its most baffling problems.

From the viewpoint of the home constructor, at least, it is fairly safe to say that an "ideal" solution has never been found. Individual designs can variously be criticised as too expensive, too complex, too clumsy or not capable of giving adequate performance.

GOOD BANDSPREAD

The difficulties arise, partly, because amateurs want extreme spread on bands which are widely separated in terms of frequency, each one relatively narrow, yet each different from the other in actual coverage.

Over and above this, many amateurs require general coverage, or something approaching it, either to permit shortwave listening outside the regular amateur bands or to allow the set to be used with crystal-locked VHF converters. For this latter purpose, continuous coverage is required of a band not less than 4 Mc/s wide.

To satisfy these various and conflicting requirements is no easy task.

Most commercial communication receivers meet the situation by providing two ganged capacitors—one bandset the other bandspread—two precision dials suitably calibrated, a wavechange switch and a whole nest of carefully matched coils, each with its separate core and trimmer.

The result can be satisfactory but is necessarily complex and beyond the means of any but the most painstaking amateur to duplicate in the home workshop. Nor are special bandspread kits much help, unless the constructor's purse is very well padded.

Many home builders have gone right the other way, therefore, using just the one ganged tuning capacitor and plug-in coils, the various tappings and pin connections being arranged to give the required amount of coverage as each different set of coils is plugged in.

The coils have variously been trimmed by small capacitors built into each former or else by means of hand trimmers brought out to knobs on the front panel.

MECHANICALLY CLUMSY

The plug-in coil scheme is electrically simple and efficient but band changing is quite a chore and the coils inevitably suffer from frequent handling or, what is worse, become mislaid altogether.

In our new tuner, we have tried to steer a middle course—one that should appeal to many amateurs.

The coils are all permanently built-in and selected by a wavechange switch so that any band between 3.5 and 28 Mc/s inclusive is available at the turn of a knob.

When brought into circuit, the coils are peaked by three small capacitors, one serving as an oscillator "Bandset," the other two as manual aerial and RF trimmers.

The use of manual trimmers is a vital contribution to simplicity because it obviates the need for a large collection of preset trimmers, as well as the use of iron cores and/or careful matching of the coils.

What is no less important, by using the trimmers either well in or well out of mesh, more than one band can be covered, if desired, on the one set of coils. By careful planning, we have been able to cover all six amateur bands and provide a 4 Mc/s band for VHF converters—all with four sets of coils and a standard 5-position switch.

But more about this later.

A further basic difficulty with amateur of communication receivers lies in the choice of intermediate frequency.

By using a relatively low figure, good selectivity can be obtained but only at the expense of image ratio. The image position improves as the IF is increased but it then becomes very difficult to obtain adequate selectivity.

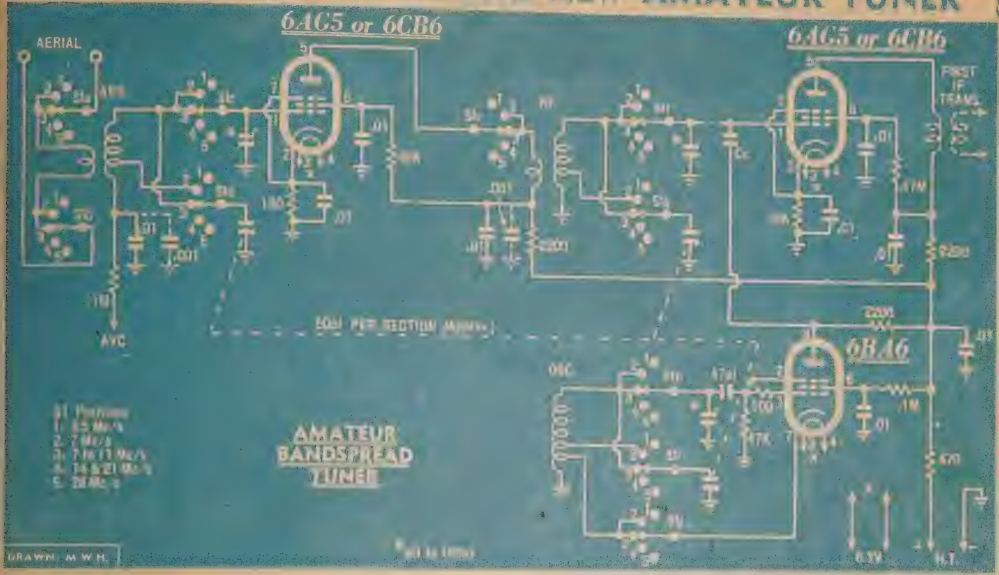
The designer has three main courses open to him as follows:

(1) Use a higher than normal intermediate frequency, say, about 2 Mc/s, and resort to special circuit tricks to increase the natural selectivity of the IF channel.

This scheme has the disadvantage of requiring special components and circuitry and has limited appeal for that reason.

(2) Use the double-change superhet

CIRCUIT DIAGRAM OF THE NEW AMATEUR TUNER



A standard switch and 4 sets of coils allows this new tuner to give bandspread coverage of six separate Amateur bands, as well as 4 Mc/s range for use with VHF converters. The use of a separate electron-coupled oscillator valve, rather than a composite triode-pentode frequency changer eliminates all suggestion of oscillator pulling with adjustment of the manual aerial and RF trimmer.

principle, with a high first intermediate frequency—from 2 to 5 Mc/s—and a much lower second IF, 455 Kc/s or less.

This scheme makes possible a good image ratio and high selectivity as well and is much favoured for the more elaborate receiver designs. There can be catches to it, however, notably the appearance of spurious carriers due to harmonics of the second oscillator penetrating the signal input circuits.

(3) Use a normal 455 Kc/s channel and combat image problems by seeking the highest possible selectivity ahead of the frequency changer.

DESIGNED FOR 455 Kc/s

This last approach is the one we have adopted for the tuning unit in its present form, without ruling out the possibility of adapting it later for the others. In any case, little more would seem to be required than an alteration to the inductance of the oscillator coils and the possible inclusion of padding capacitors to assist tracking.

There is, of course, nothing magical about the figure of 455 Kc/s, apart from the fact that it is a recognised standard for IF channels. Components are readily available and the channel is kept clear of transmitters.

Using this figure, no image troubles are likely to occur at 3.5 and 7 Mc/s while images at 14 Mc/s can be minimised by running the receiver's oscillator on the low side of the signal frequency. This prevents strong "19-metre" broadcast stations repeating into the amateur band.

On higher frequencies image effects are inescapable but, while a receiver is obviously better without them, they need not be of such magnitude as to invalidate the general approach. A lot of QSO's have been made in the past, and many more will be made in the future using simple 455 Kc/s superhets.

That's the general picture. Now for a more detailed discussion of the new tuning unit:

Probably the most important considerations are the coils and bandspread. As mentioned before, difficulties arise due to the fact that the high frequency amateur bands are widely separated in terms of frequency and their widths vary greatly.

With plug-in coil systems in the past there has been a tendency to design each coil set so that the amateur band it covers is spread over the entire dial scale. The weakness of this idea is seen when the widths of the various bands are considered.

The "10-metre" band, for example, is from 28 to 30 Mc/s (2 Mc/s) while the 40-meter band is from 7.0 to 7.15 Mc/s (0.15 Mc/s). If we follow the old rule, the tuning range on the 10-metre band will be over 13 times greater than on the 40-metre band.

CROWDED SCALE

Clearly, this is not a very desirable state of affairs. In practice it is found with most dial mechanisms that the scale is crowded for the wide band and that it takes too long to sweep across the range on the narrow.

The more logical way to determine the amount of bandspread required is to consider the selectivity in relation to the smallest increment of frequency which can be read clearly. IF channels in modern communication receivers are of necessity fairly selective and we feel that it should be possible to read increments of 5 Kc/s or smaller.

Using a slow motion dial and a semicircular scale with diameter about 8in, the band coverage should not, ideally, be greater than about 1 Mc/s if this is to be the case.

With the 2 Mc/s sweep required to cover the 10 meter band and a 4 Mc/s sweep needed to cover the VHF bands with the receiver used as a tunable IF, clearly the ideal is not possible.

In the coil data for this tuning unit, we believe that we have reached a reasonable compromise.

1 Mc/s COVERAGE

Most activity on the 10-metre band is between 28 and 29 Mc/s and the spread can be adjusted for 1 Mc/s coverage. If you wish to listen between 29 and 30 Mc/s it is a simple matter to readjust the bandset capacitors when the intermediate calibrations over the 1 Mc/s range will hold fairly well.

Similarly on the 11-metre band you can band set to tune between 27 and 28 Mc/s. The ratio of maximum to minimum frequency over the entire range is small and it is easy to maintain the high dynamic impedance and Q required for good gain and image rejection respectively over this range.

This same set of coils could have been used to cover the 15-metre band but even here there is something to be gained by using relatively low C circuits. Therefore, we installed a separate set of coils for 21 Mc/s and by readjusting the bandset capacitors this same set of coils was used for 14 Mc/s. With modern high gm valves there is no real difficulty in obtaining good performance

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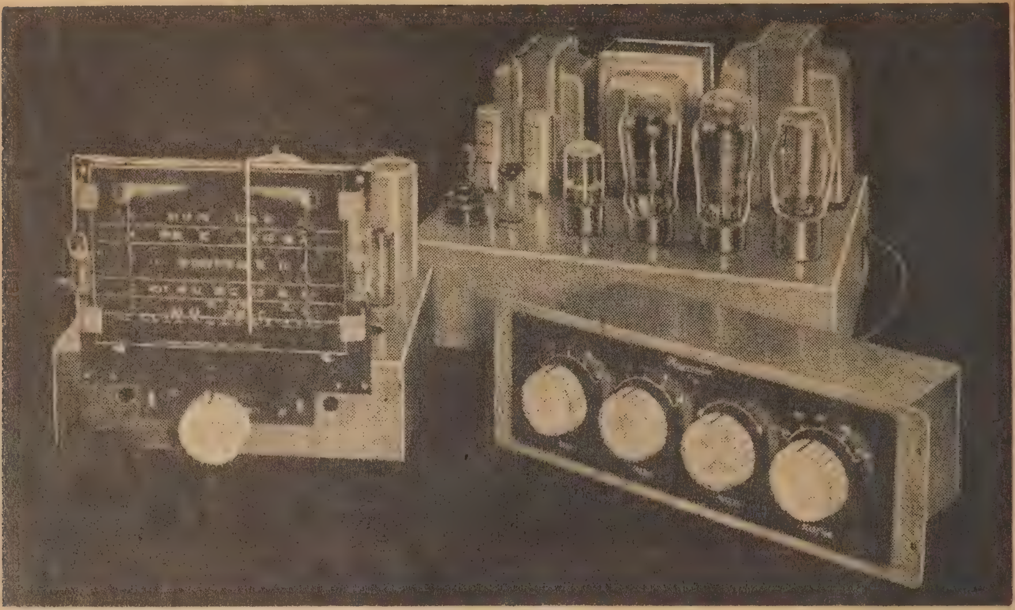

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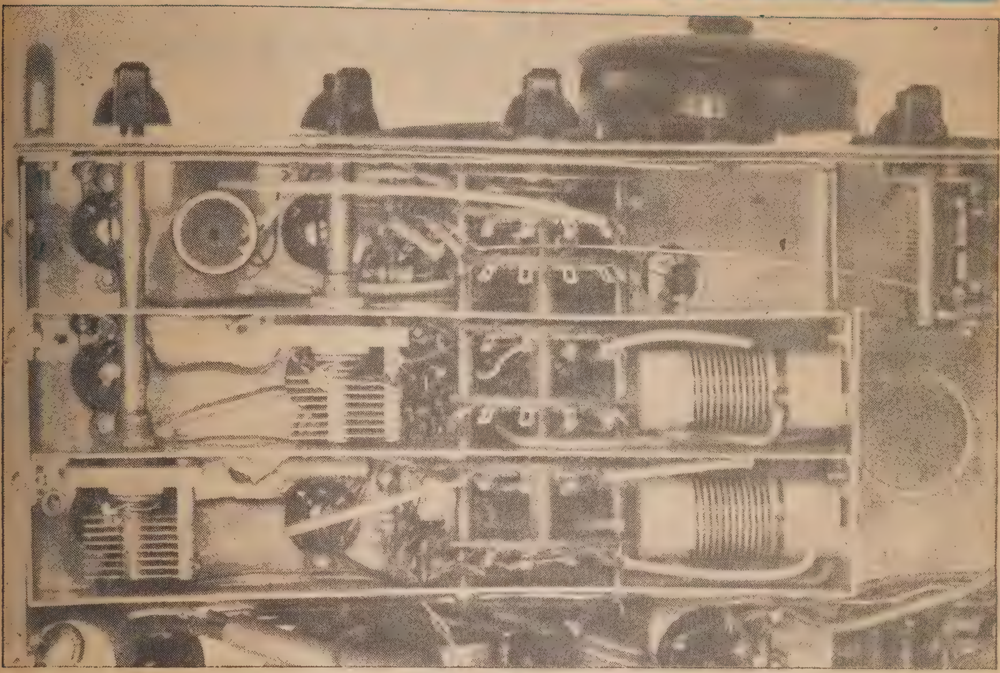
UNDERNEATH VIEW OF BANDSPREAD COIL UNIT



A hole was cut in the chassis of the Short-Wave Seven to accomodate the coil unit. Oscillator compartment is seen at the top, then the RF and aerial compartments. Coils covering the 21 Mc/s and 14 Mc/s bands are under the chassis and with a couple of exceptions the connecting leads are very short. The oscillator bandset capacitor has been shifted from its "normal" position in order to fit the panel layout.

on this latter band despite the lower than optimum L/C ratio.

The main disadvantage is that a compromise has to be made in the matter of bandspread. While the ideal would be to have about 0.5 Mc/s coverage in each case, it is not possible to do this with simple switching systems due to the change in L/C ratios. The range has to be adjusted to about 0.4 Mc/s to cover the 20 metre band which means that the coverage is much greater than 0.4 Mc/s on 15 metres. However, the tuning is still not too sharp and we feel that is a small price to pay for the saving of a complete set of coils.

STANDARD SWITCH

Futhermore, the standard "Oak" switch has two poles and 5 positions on each bank. By keeping down to 5 positions to cover all bands it is possible to simplify the unit appreciably. Only six such banks are required in all, against a total of ten had 12 position single pole wafers been used. Again there is a saving in cost, size and complexity.

Reception on frequencies below 14 Mc/s is more likely to be limited by atmospheric noise than by noise generated inside the receiver and even with a 455 Kc/s IF images are unlikely to be a problem. Therefore construction can be made easier by winding the 40 meter and 80 meter coils on 8mm. formers.

There formers are made for television IF strips and are available in at least one brand with the required 5 connections. They are normally supplied complete with shield can. Coils wound on these formers usually have an unloaded Q of the order of 100 compared with a Q of the order of 200 for coils wound on the ⅜in formers used for the two high frequency sets.

Incidentally, if some readers are thinking in terms of adapting commercial television tuners for use on the amateur bands, the big objection is that it is not possible to use coils of sufficiently large dimensions to obtain good efficiency. In the case of a television tuner the problem is often to obtain sufficient bandwidth. With the amateur tuner it is to obtain sufficient selectivity.

Even with the shield partitions only 1 3/8in apart as in our case and appreciably damping the coils, the effective Q is much higher than for coils of the same inductance wound on the 8mm formers.

FOR VHF WORK

The inductance of the "40 metre" coils is chosen so that the range from 7 to 11 Mc/s can be covered and the receiver used as a tunable IF for VHF converters on the 2, 5 and 6 metre bands. For this range the bandset capacitors are set close to minimum capacitance and the bandspread capacitor connected across the entire coil. A check with the circuit will make the arrangement clear.

The 7 to 11 Mc/s range has become fairly standard in amateur circles throughout the world as the range for VHF converters and there is everything to be said for our keeping to it so that the tuner can be used with existing or projected units.

It does, in fact, set the minimum capacity range of the 3-gang bandspread capacitor since the ratio of maximum to minimum frequency is the greatest of all the bands.

Coverage of the 40 metre band is obtained by connecting the 3-gang to taps down the coil and increasing the capacity of the bandset capacitors. A total coverage of about 0.5 Mc/s gives an acceptable tuning ratio.

Amateur allotment on 80 metre band is from 3.5 to 3.8 Mc/s. You could, if you wish tap the coils to give about 0.5 Mc/s total spread but always remembering that the construction of a tuner of this type is a fairly long-term spare time project for most amateurs we decided to simplify the 80 metre coils by leaving out the bandspread tap and accepting the wider coverage.

Bandspread obtained by tapping the coils, by the way, has advantages over alternative systems in that it is easily adjusted to the requirements of the different bands and does not require additional accurate trimmer capacitors.

CAPACITOR LAW

For a linear scale with this system the capacity/rotation characteristic should be nearly linear but unfortunately three gang units of the required capacitance are not readily available. The three gang unit made available by "Rob

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lan" shown in the photographs has plates of the same shape as the standard broadcast gang and tends to make the scale crowded towards the low frequency end of each range. However, when the bandset capacitors are set to centre each range, the scale shape is acceptable.

Coupling from the aerial to the first tuned circuit and from the plate of the RF amplifier stage to the grid of the mixer is inductive. In determining the coupling to the aerial we had in mind that most amateurs would use either a 70 ohm or a 300 ohm balanced line. An untuned aerial is obviously not as efficient but can be used by grounding one aerial terminal and using the other to connect the aerial wire. Coupling is deliberately on the loose side in order to allow the circuit to tune sharply and tend to reject images.

LOOSE COUPLING

Likewise, coupling between the RF amplifier plate and the tuned mixer grid coil is deliberately on the loose side. This approach still results in appreciable gain due to the high gm RF amplifier valve.

As a matter of passing interest, designers of coils for dual-wave receivers covering a wide frequency range usually employ tight coupling between coils so that selectivity will not be too great with resultant tracking problems. A relatively narrow frequency range plus hand trimmers make things much easier in our case.

The electrical circuit is probably the next most important item for discussion.

The additional tuned circuit associated with the RF stage assists in rejecting image signals as already discussed. In addition the RF stage provides amplification so that noise generated by the mixer stage is masked.

Best signal-to-noise ratio would be obtained with a neutralised triode or a "cascade" arrangement as frequently used at VHF. However, it is much more convenient to use a high gm pentode, the noise of which is only a little higher than that of the triode and almost always masked by external noise at frequencies below 30 Mc/s.

The valve should ideally have a remote cut-off characteristic so that strong signals on adjacent frequencies will not cross-modulate the required signal. The 6BA6 is excellent in this respect and at the same time has a fairly high gm. It could be used in place of the 6AG5 or 6CB6 in cases where cross-modulation is likely to be a problem.

HIGHER GAIN

The 6AG5 or 6CB6 on the other hand has a higher gm and will result in higher gain and an improved signal-to-noise ratio. It has sharp cut-off characteristics and is not ideal for the application of AVC in the ordinary way.

However, with a poorly regulated screen supply the screen voltage increases with increasing negative control grid bias and the valve is able to accept a fairly large control voltage.

Maximum gain is achieved with the value of cathode bias resistor shown. You will only be able to use this value without instability if shielding between aerial and RF circuits is perfect.

Remember that the gm of the 6AG5 or 6CB6 is very high and good performance can be obtained without realising the full gain of which it is capable. At the same time it is very desirable that the RF stage has no tendency toward oscillation. The standard decoupling arrangements in the AVC and high tension lines are included.

A sharp cut-off high-gm valve is required for the mixer stage and since a 6AG5 is already in use it is logical to use a second 6AG5 or 6CB6 in this position. It is operated with low plate current so that the mixing action takes place in the plate circuit. This circuit gives a very sensitive mixer together with a low noise level.

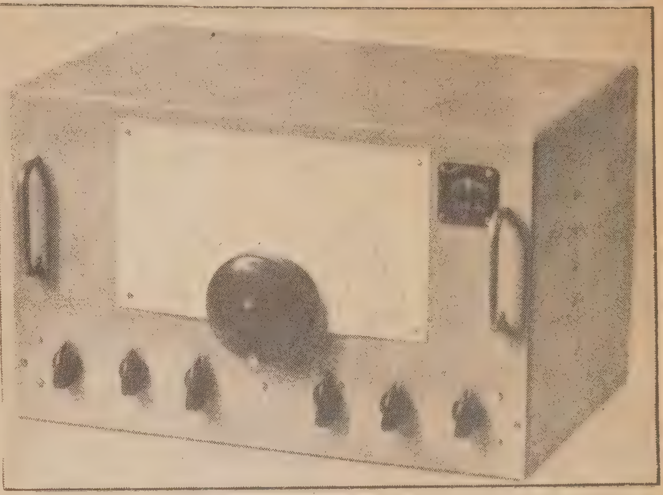
A further advantage is that the loading on the tuned circuit is low and therefore its selectivity is not prejudiced.

The oscillator stage demands special consideration since the ability of the receiver to stay tuned accurately to a given frequency depends largely on the stability of its output. Since we are using hand trimmers it is especially necessary that the frequency of the oscillator be independent of the setting of the aerial and RF trimmers.

The well-known electron-coupled circuit using a pentode valve is particularly good in this respect since the screen and suppressor can be effectively grounded for RF, shielding the frequency determining circuits of the oscillator from the output circuit. Further, the RF output can be developed across a low value load resistor, making the output relatively independent of loading.

Coupling to the mixer is via the capa-

OLD SET BROUGHT UP TO DATE



The old receiver brought up to date and installed in a metal cabinet. A slow motion movement available from MSP Pty. Ltd. was used and in conjunction with the 9in by 5in card makes for easy reading of frequency on the wider bands.

COIL DATA

3.5 Mc BAND (8 mm formers)
  Aerial: Pri.—10T 34 B & S enam.
    Sec.—80T 34 B & S enam. spaced 1/16 from pri.
  RF: Pri.—20T 34 B & S enam.
    Sec.— 80T 34 B & S enam. spaced 1/16 from pri.
  Oscillator: 75T 34 B & S enam. tapped at 20T
    All coils closewound.

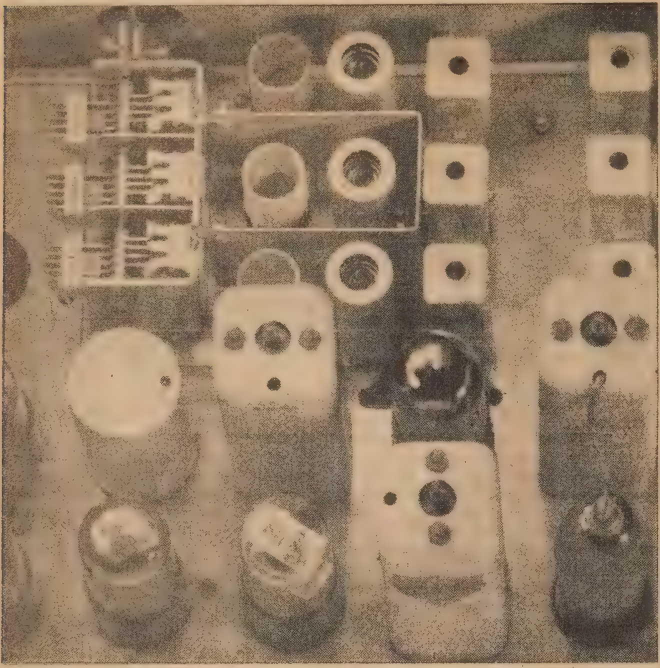
7.0 Mc Band (8 mm formers) The 7 to 11 Mc range is also covered with this set of coils.
  Aerial: Pri.—6T 34 B & S enam.
    Sec.— 52T 28 B & S enam. spaced 1/16 from pri. Tapped at 25T.
  RF: Pri.—12T 34 B & S enam.
    Sec.—52T 28 B & S enam. spaced 1/16in from pri. Tapped at 25T.
  Oscillator: 48T 28 B & S enam. tapped at 10T & 23T.
    All coils closewound.

14 & 21 Mc Bands ($\frac{3}{4}$in. formers)
  Aerial: Pri.—3T 28 B & S enam. close-wound.
    Sec.—12T 24 B & S enam. spaced $\frac{3}{4}$in. Tapped at $3\frac{1}{2}$T. 1/16in. from pri.
  RF: Pri.—6T 28 B & S enam. close-wound.
    Sec.—12T 24 B & S enam. spaced $\frac{3}{4}$in. Tapped at $3\frac{1}{2}$T. 1/16in. from pri.
  Oscillator: 12T 24 B & S enam. spaced $\frac{3}{4}$in. Tapped at 3T & $3\frac{1}{2}$T.
  Secondaries wound on 16 TPI grooved formers.

28 Mc Band ($\frac{3}{4}$in. formers)
  Aerial: Pri.—2T 28 B & S enam. close wound.
    Sec.—7T 24 B & S enam. spaced 7/16in. Tapped at $1\frac{1}{2}$T. 1/16in. from pri.
  RF: Pri.—4T 28 B & S enam. close-wound.
    Sec.—7T 24 B & S enam. spaced 7/16in. tapped at $1\frac{1}{2}$T 1/16in. from pri.
  Oscillator: 7T 24 B & S enam. spaced 7/16in. Tapped at 1T and $1\frac{1}{2}$T.
    Secondaries wound on 16 TPI grooved formers.

citor, shown as Cc in the circuit diagram. Physically, it consists of about six turns of hook-up wire wrapped around the lead from the switch to the grid of the mixer valve. An adjustment is possible by adding or subtracting turns and this adjustment should be carried out on the 10-metre band.

Oscillator injection on the other bands will progressively become less as the frequency is lowered and the reactance of the capacitor becomes greater. However, this is no real disadvantage, since it is only on the higher frequency bands that there is difficulty in obtaining sufficient gain.



Coil unit fits into the space previously occupied by two valves and a plug-in coil in the Short-Wave Seven. The 455 Kc IF channel appears in the foreground. The lead from the mixer plate to the 1st IF transformer is a short length of low capacity coaxial cable running on top of the chassis.

A 100 ohm stopping resistor is placed directly in the grid of the oscillator valve as a standard precaution against squegging of the oscillator, which sometimes occurs with relatively high gm valves. The chances are that it will not make any difference to the performance of the oscillator, so you can please yourself about including it.

OSCILLATOR FLUTTER

The oscillator is not unduly sensitive to changes in high tension voltage, but on the higher frequencies there is a possibility of "flutter" due to changes in high tension voltage through the action of the AVC system. If this proves a problem in certain receivers you could try supplying the oscillator plate and screen through a separate decoupling system consisting of, say, an 8 uF electrolytic and a 4,700 ohm resistor.

Better still, the oscillator could be supplied from a voltage regulator tube which would hold the voltage constant with changes in mains supply voltages.

Our remaining comments are concerned mainly with the mechanical side of the new tuning unit.

The laboratory model was constructed on a chassis 8in by 4½in by 2in with the object of establishing the minimum practical size. Readers revamping older receivers will have varying shapes available and may have to alter the design to suit their particular set.

While it would be possible to cut a little off the 8in dimension it would be extremely difficult to reduce the other two. In fact, the unit would be made much easier to wire if the 4½in dimension could be increased to 6in, making the space between the shields effectively 1¾in or a little greater. As it is, a fine soldering iron and a fair amount of skill are required to complete the job.

H.F. COILS

Coils for the highest frequency band are mounted above the chassis, directly above the switch with the valves alongside. Connecting leads could be very little shorter even with a plug-in coil system. A shield partition separates the RF coil from the other two. However, there may be cases where the additional shielding provided by a 1¼in diameter can over either or both the aerial and RF coils would be of assistance in maintaining stability.

The 7 and 3.5 Mc/s coils are also mounted above the chassis in shield cans. The relatively long leads between these coils and the switch are not particularly important.

The set of coils covering the 14 Mc/s and 21 Mc/s bands is mounted under the chassis and is visible in the underneath photograph. The oscillator coil is mounted vertically between the control shafts for the aerial and RF trimmers, while the aerial and RF coils are mounted horizontally.

With this arrangement, magnetic coupling between the coils for various bands is negligible and there is no need to resort to special shorting switches to prevent absorption from coils not in use.

Small components around the valve sockets should be installed before the switch or the shield partition. It is possible to remove and replace them after the switch and partitions are in place, but it is a much less tedious job if done beforehand.

EARTH CONNECTIONS

The shield partitions should be well bonded to the main chassis to prevent feedback, and at the same time care should be taken to make earth return points so that a minimum of current from each point flows through the chassis. Use a point near the valve socket as a common earth return for each stage for the two high-frequency sets of coils at least.

There should be clearance holes where the control shafts for the aerial and RF trimmers come through the shield partition and the front panel. Otherwise intermittent contact between the shafts and the chassis will result in noise when the shafts are rotated. If the bearings of the particular trimmer capacitors you use are not good enough to carry the extended shafts, then a fibre bush could be used where the shaft goes through the hole.

No doubt some readers will have trimmers suitable for the tuner except that the control shafts are too short for use in the aerial and RF positions. There is an easy method of extending the shafts in accurate alignment and to apply it you will need a fairly heavy soldering iron, shim brass and some tinned copper wire.

EXTENDING SHAFTS

Take a strip of shim brass about ½in wide and wrap it around the shaft to determine the length required so that the ends of the brass just meet. Then, with the brass wrapped around the junction of control shaft and the extension, bind tightly over the brass with the tinned copper wire. Provided the shafts are the same diameter and the binding is tight the shafts will be brought exactly into line and the soldering operation can proceed. Do not tin the brass and the shafts beforehand, as this will be sure to affect the alignment, but it may be helpful to coat the shafts with paste flux first in order to assist the flow of solder.

After the joint has set the tinned copper wire binding can be removed, usually simply by unwinding it, and the outside of the joint cleaned up with the aid of a file and emery cloth. The finished joint should be very strong and greater in diameter than the shaft only by the thickness of the brass shim.

If you make the unit in the smallest possible space you may find it difficult mechanically to place the .01 uF bypass

(Continued on Page 105)

Checking Amplifier Damping Factor

The damping effect of an amplifier on the associated loudspeaker is a frequent point of controversy in audio circles. This short article from "Radio & TV News" explains how damping factor can be assessed for any given amplifier.

THE knowledge of what your amplifier's damping factor is has become more important recently.

With high-efficiency speakers it was usually felt that the higher an amplifier's damper factor the better this would be for the speaker in damping out undesired resonances.

However, with the advent of high-quality, low-efficiency speakers, and especially with such speakers mounted in infinite baffles or other such enclosures that do not add to the bass response, the use of an amplifier with too high a damping factor is undesirable.

This would result in over-damping the speaker and reducing its output, especially at the bass end. Perhaps the day is not too far away when speaker manufacturers will specify optimum damping factors for their speakers when used in specific enclosures.

VARIABLE DAMPING

Several values might be given for different types of listening tastes. The amplifier manufacturers have already started the ball rolling by providing, in some cases, a variable damping control that allows the user to set the damping factor at whatever value he requires.

At present most speaker manufacturers are quite reluctant to quote any optimum damping factors for amplifiers to be used with their loudspeakers.

This is partly due to the fact that not enough experiments have been done along these lines and also that the results obtained at various damping factors is so subjective.

Some listeners might like the way their speakers sound with one certain damping factor, others might prefer another value.

Typical values of amplifier damping factor depend, in the main, on the output circuit used. For example, with push-pull triodes without feedback the damping factors are in the range of 2 to 4. With push-pull beam power tubes the damping factor is apt to be less than this unless negative feedback is used. With large amounts of negative feedback, tetrode damping factors may run as high as 10.

Recent designs using triodes with feedback or "Ultra-Linear" stages with feedback may have damping factors from 10 to 30.

The measurement of an amplifier's damping factor is quite simple. This article will describe two methods of measurement.

To use the variable resistance method a signal voltage is introduced into the input of the amplifier to be checked. This signal may come from an audio generator or even from the AC heater supply of the amplifier itself.

Next the load is removed from the output terminals and the output voltage is measured with a suitable audio voltmeter.

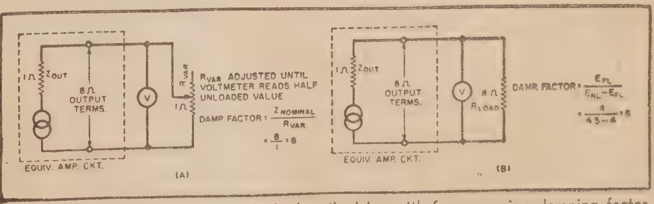
The input signal should be kept well below the overload point of the amplifier and below that point that might cause arc-over in the unloaded output transformer. Then a low value variable resistor (the author uses a 15-ohm wire-wound unit) is connected across the output terminals and this is adjusted until the voltmeter reading falls to one-half the unloaded value.

Under these conditions the voltage across the variable resistor is equal to the voltage across the actual output impedance of the amplifier. See (A) of diagram.

Now the variable resistor is removed and its resistance is carefully measured. This value of resistance is equal to the output impedance (technically, the effective source impedance) of the amplifier.

If this resistance value is simply divided into the nominal output impedance of the amplifier (the value frequently marked on the amplifier itself), the result is the damping factor.

For example, in the diagram shown assume that the value of the variable resistor is 1 ohm and that the measurement is being made on the 8-ohm tap of the amplifier, the damping factor is 8/1, or 8.



Equivalent circuits for two methods described herewith for measuring damping factor.

NEGATIVE DAMPING

If it is found that the output voltage of the amplifier should rise when the load is applied, then this indicates that the amplifier has a negative damping factor.

The resistance value that causes the loaded output voltage to be doubled is equal to the negative impedance of the amplifier.

Several problems may be encountered in using this method. One is that with amplifiers having very high damping factors, it might be difficult to adjust and to measure the very small values of resistance required to make the voltage drop to one-half.

Another problem occurs when very low resistances are shunted across the output terminals of an amplifier; the primary impedance of the output transformer falls and the plate current through the output tubes may be excessive.

In one case where this method was used, the plates of the output tubes became dangerously red.

Another method that will yield the same answer but with none of the drawbacks is described below.

To use this method a signal is applied to the amplifier and an output voltage measurement is taken with no load connected. Let us call this no-load voltage Enl.

Next, a resistor with a value equal to the nominal output impedance is connected to the output terminals of the amplifier. The amplifier is now properly matched. Then, a second voltage reading is taken under these fully loaded conditions. Call this full-load voltage Efl.

SIMPLE RATIO

The damping factor of the amplifier is simply equal to the full-load voltage divided by the difference between the no-load and the full-load voltage, or Efl/(Enl—Efl).

This may be recognised as the inverse of the regulation formula. As a matter of fact, the damping factor of an amplifier is a measure of its regulation.

If, for example, the output voltage falls only a very small amount when the circuit is loaded, its regulation is good (low) and its damping factor is high.

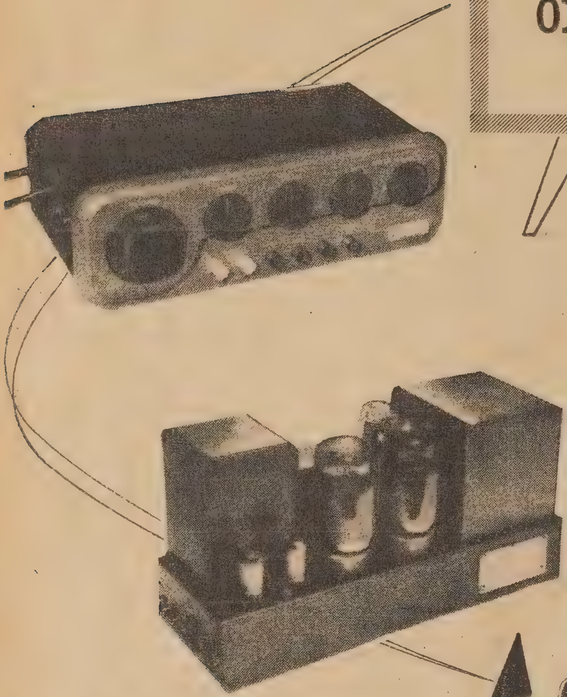
To show that this method gives the same results as the variable resistance method, consider (B) of the diagram.

Assume that the same amplifier with its 8-ohm output tap and its 1-ohm output impedance mentioned before is used. Assume further that the no-load voltage measures 4.5 volts. There is no drop across the 1-ohm output impedance with no current flow.

With the 8-ohm load connected, the full-load voltage will fall to 8/9 the no-load voltage, or 4 volts, in the simple series circuit. The damping factor then is 4/(4.5—4), or 8.

This is the same value that was obtained with the first method described above.

Obtaining the damping factor, using either of the methods described, may help you to evaluate the performance of your loudspeaker system and it will certainly give you one more important characteristic of your amplifier.



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FROM THE SERVICEMAN WHO TELLS

A relatively simple fault in an ordinary receiver is worthy of mention this month because it raises a question that has been asked many times: Should set manufacturers fit suitable fuses as standard equipment on all sets? I have endeavoured to cover points both for and against the idea, but readers may have their own ideas.

BUT before dealing with specific case histories, I would like to acknowledge a letter from Mr. W.W., of Roseville, N.S.W., which is reproduced on this page.

It is virtually self explanatory and—apart from complimenting Mr. W.W. on a smart piece of observation and servicing — there is very little comment I could make, without simply repeating what I said in the November issue. However, to any doubting Thomases who may still be with us I would like to say, simply, "See what I mean?"

To change the subject slightly, and prompted by Mr. W.W.'s faulty speaker, have any readers noticed the amount of speaker trouble caused by the outside edge of the cone coming unstuck from the metal frame?

ONE BRAND

I have had several cases lately, mostly in the one brand of speaker. The result is a most distressing rattle, and one may be pardoned for imagining that the "innards" of the thing have come unstuck and that nothing short of a new cone and voice coil will cure the trouble.

This impression is likely to be heightened by the fact that the unstuck portion of the cone is not always immediately obvious. If the entire cone has come adrift, of course, then there is little doubt about it, but it frequently happens that no more than a quarter of the circumference is affected, the remainder being securely held.

It is only when one exerts some extra pressure on the cone that the trouble can be seen or, alternately, the rattle may be temporarily cured by holding various portions of the circumference with the fingers.

Fortunately, once found, the trouble is not hard to fix. My technique is to apply a fairly liberal quantity of cellulose cement to each face and then hold them together with a light pressure. Often this need be no more than the weight of the speaker itself resting face downward. However, make sure that the packing ring around the cone is thick enough to extend beyond the metal frame, and thus convey the pressure to the right place.

TYPE OF GLUE?

So far as I can tell, the cellulose does a permanent job, but I would like to know (1) if this is the cement used by the makers, why does it seem to fail so frequently, or (2) if they use a different cement, is it really as good as it is supposed to be?

Coming to my actual stories for the month, the first one concerns an imported high quality amplifier and associated control unit. It was of well-known make and had performed satisfactorily for several months, the present trouble being a substantial level of background hiss and crackles.

The owner was an obvious high fidelity fan who, equally obviously, knew very little of the workings of such devices. In fact, he was quite worried about the trouble, fearing that it indicated that the whole equipment was fundamentally unsound and that he had made a bad buy in choosing that particular brand.

I did my best to reassure him on this point, explaining that a very minor fault could easily cause a lot of trouble of this nature and that he need not lose confidence in his equipment as a result.

Incidentally, it is quite surprising the number of people who get ideas like this. A favourite one is to the effect that every radio manufacturer is unable to avoid producing a small number of individual sets (not designs), which are, as they express it, "duds."

"Like motor cars, you know. Every now and then someone gets a 'dud' motor car, and it is never any good. I suppose radio sets are much the same."

Well, I don't know about the motor car industry, but I do know that such things are pure myths as far as the radio trade is concerned. When all is said and done, any radio set is only a collection of component parts and, while it can easily happen that a new set has one or two components that fail prematurely, it would surely be a mighty coincidence that caused, say, 90 per cent of the components in any one set to be faulty.

And that is what would have to happen in order to produce the so-called "dud" set we have been discussing. (As far as that goes, I imagine much the same reasoning could apply to the motor car industry, but I'll let someone else handle that one.)

Anyway, to get back to the job in hand. On the bench the combination quickly showed the trouble the owner had mentioned and I immediately suspected that there was more than one fault in evidence. Part of the noise was a steady rushing sound, more or less constant, but which varied with the setting of the volume control. In addition, there was an erratic crackling sound which seemed to be independent of the volume control.

AMPLIFIER OK

Shorting the first grid of the main amplifier immediately removed every trace of noise, thus clearly establishing that it was in the control unit. Fortunately, there was a circuit pasted in the lid and this saved a lot of time in finding my way around the layout.

Having located the volume control I then concentrated on the valve ahead of it. It was an F86 and, while normally a very low noise valve, these can be just as noisy as any other when something goes wrong. Pushing it and tapping it it made slight changes to the level, though proved nothing very definite.

I removed the valve, squirted some contact cleaning solvent into the socket, and on to the socket pins, then put the valve back in place. If anything, this reduced the noise slightly, but not enough to be of much help. I had no spare F86 on hand, but I suddenly realised that there was one in the main amplifier. It took only a few seconds

Dear Sir,

Prompted by your column in the latest issue of R. TV & H. I am describing a repair I carried out on a mantel set recently, and I think it illustrates only too well the points you raised in that article. Incidentally, it was thanks to you that I was able to diagnose the fault correctly and so track it down with very little trouble.

I was called over to repair a neighbour's wireless which had stopped suddenly. The fault was simple—an O/C rectifier filament.

After I had replaced the valve, the owner suggested that I might be able to repair another set she had. The complaint this time was distortion after the set had been running for a couple of hours.

The set was in operation at the time and so I was able to check it for myself and confirm the owner's report. I then remembered a similar case in one of your columns (R. & H. July, 1949) and suggested that the speaker might be at fault. I decided to take the set home and check it.

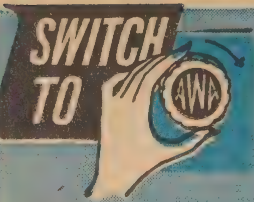
On the bench I slipped the set out of the cabinet, fastened a thermometer to the speaker field, and put the set on a test run. After three hours the temperature was steady at 45 degrees C., but the distortion was not present.

Still believing I was on the right track. I slipped the set back into its cabinet. After 20 minutes more running the temperature had risen to 60 degrees C. and the distortion was present. A new speaker cured the trouble.

While I was working on the set I noticed that several parts had been changed since the set had been bought. I subsequently learned that the set had been in and out of service shops ever since it was bought in an effort to have this fault corrected.

I hope this case will be of interest to you and other readers.

Yours, etc.,
W. W. (Roseville. N.S.W.)



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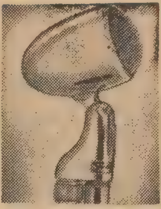
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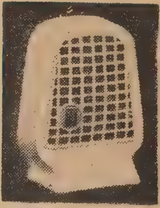
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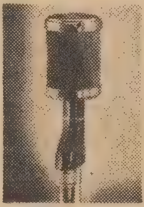
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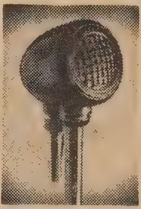
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to swap them over, whereupon the trouble vanished.

This was reasonably gratifying, but I still had to locate the crackling sound. This prospect didn't worry me so much but I was scared the trouble would clear itself before I could find it.

The nature of the noise suggested a noisy resistor, and those in the plate circuits of the two triode stages seemed to me the most likely culprits. I shorted out the grid of the second stage and noted that the crackle dropped appreciably, but was still very much in evidence. This suggested that the trouble was in both stages.

To check the plate resistor of the second stage it seemed easiest to replace it, which I did. This also reduced the crackle but without curing it completely further confirming my diagnosis.

REPLACEMENT

Thus encouraged, I replaced the plate resistor of the first stage, and this removed the last trace of the trouble. After a thorough check-over for any other likely troubles, and a few hours running test, I felt confident in returning it to the owner.

I must admit that one valve and two resistors all contributing to the same symptoms is a rather unusual circumstance, particularly in a piece of new equipment, but I still feel that it was a long way from being the "dud" the owner feared.

More correctly, it was a well-made, well-designed piece of equipment, capable of doing all the remarkable things demanded by high-fidelity enthusiasts, and undoubtedly capable of giving many years of top performance with no more than the usual amount of servicing.

I said as much to the owner when he came to collect it and I think my reassurance, plus the obvious improvement in performance, finally convinced him that he had been worrying unnecessarily. At any rate, he was a happy man when he left the shop.

My next story concerns a very ordinary five-valve receiver, which looked like being a very ordinary job. In most respects I suppose it was, but there was one aspect of it which I think bears considering.

QUITE DEAD

As I received the set it was quite dead, the owner's story being that it had simply stopped in the middle of a program and that no amount of coaxing could get even a crackle from it.

"But I don't think it's valve," was his concluding comment, "they all seem to light up properly."

Maybe I'm getting old or something, but somehow I just couldn't bring myself to explain the limited value of this observation. People never seem to learn anyway, so I contented myself with a general sort of reply to the effect that I would check it over completely.

There was no doubt about the set being dead, and I quickly established that this was due to a complete absence of H.T. Sensing a shorted electrolytic, I measured the voltage on the filament of the rectifier, expecting to find it greatly reduced.

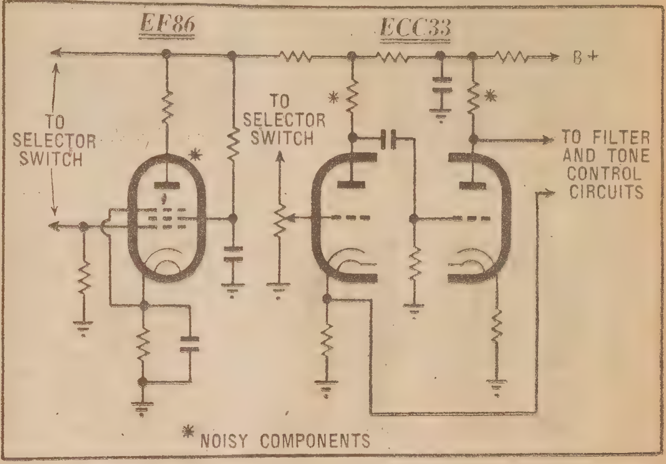
Instead I was greeted by a voltage considerably higher than would have been normal at this point, and I switched off hastily, before something blew up.

More careful checking revealed the trouble as a completely open circuit filter choke. I examined it carefully to see if there was any obvious cause, such as a faulty terminal lug, which could be repaired but there was nothing obvious. Apparently it was due to electrolysis of some kind further inside the winding. In the circumstances, I simply replaced it.

So far, this is quite an ordinary fault, even if it is not a very common one. However, the point I wish to make is the rather dangerous nature of such a fault, which may not be immediately obvious.

The absence of any load on the rectifier allows the voltage across the first electrolytic to rise rather alarmingly, and this component will not usually take such punishment for very long.

When it goes, it invariably takes the rectifier with it — but not before the power transformer has begun to emit clouds of pungent smoke. Furthermore, once the power transformer breaks down it usually provides its own short circuit, hastening its own destruction, even after the rectifier has failed completely.



This diagram illustrates the methods adopted to remove symptoms of noise in a high quality amplifier.

The final result is often a very expensive repair bill, out of all proportion to the original fault. In this case the owner was lucky. Not only was the electrolytic rather on the ancient side, but he had obviously let the set run for some time while he removed the valve shields and checked that the filaments were alight.

FUSES

The situation immediately brought to my mind the old question about the value of fuses in vital parts of a receiver to guard against just such contingencies. In fact, I went so far as to raise the question with a colleague who, as it turned out, had had some experience in this problem.

I was rather agreeably surprised to learn that the subject has not been completely overlooked by manufacturers, but rather has been discarded because of the many problems presented.

For one thing, unless a fuse and its holder are properly designed, they can create far more trouble than they save; a fact which was demonstrated quite forcibly in the old battery set days.

Many manufacturers at first made it a practice to fit a torch bulb fuse in the common HT/filament battery lead — until they realised that a large proportion of service calls were due to faulty bulb holders, loose lamps and kindred troubles.

With the advent of mains receivers another attempt was made to introduce the idea, this time employing properly designed fuses and holders. Unfortunately this also had to be abandoned.

The main problem with such schemes seems to be the relatively small margin between the normal running current of the set, and the maximum short circuit current. Obviously the fuse has to be large enough to run continuously, at all normal temperatures, with the normal current flowing through it; yet must also be small enough to fuse positively under serious overload conditions, but which may still be less than the absolute short circuit condition.

These two conditions are separated by such a narrow margin that a fuse which is completely reliable under normal conditions may provide very little real protection when it is needed.

Further, fuses which are run at a moderately high temperature, as these would have to be, tend to deteriorate, due to both the formation of oxide on the surface and to a tendency for the metal to crystallise. The result is an unnecessary set failure, often at an inconvenient time.

All this means that the problem, while not necessarily insurmountable, is at least economically rather disturbing. The designer is tempted to ask whether the inevitable increase in cost can be justified against the value of components involved and the probability of trouble. Generally, the answer would be no.

However, it is interesting to note that many current TV manufacturers are fitting fuses to their sets; a quick scan through a group of current circuits revealing a variety of ratings between one and three amps, with the highest figure in the minority. It would seem that the higher cost of the complete set, plus the higher replacement cost of the components involved, has justified a further approach to the problem.

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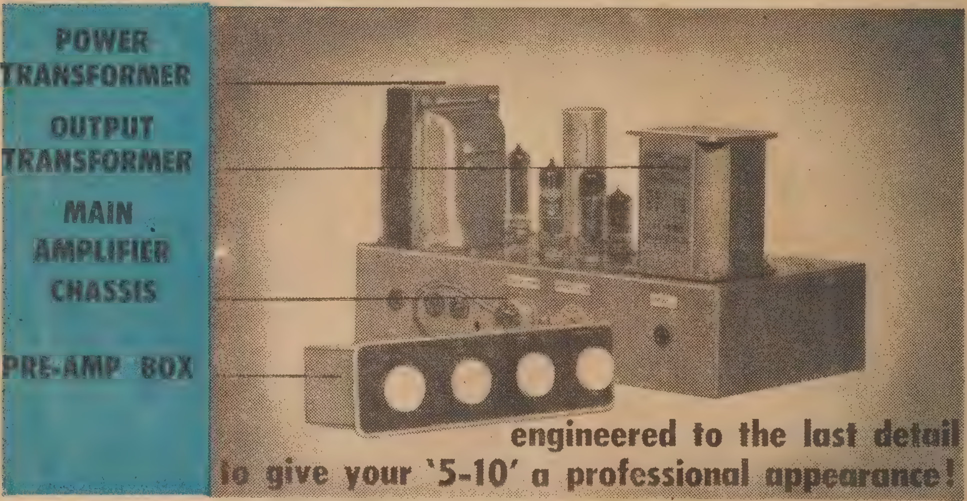

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Futhermore, one story I heard recently seems to lend point to the idea that manufacturers are definitely relying on these devices to avoid costly repairs. Since it came to me from a thoroughly reliable source, I have no doubt as to its authenticity.

It seems that a certain customer purchased a certain TV set, of reliable make, and had it duly installed in his lounge room. All went well for a couple of weeks until one night, when the set began to behave in a most erratic manner, to such an extent that the owner was forced to switch it off. Next day he contacted the service department and requested that someone come out and have a look at it.

FUSE TROUBLE

When the serviceman arrived he gave the set a routine check over and finally announced that the trouble appeared to be in the fuse. (Shades of the old battery set problem.) Unfortunately, he had no spare fuses with him, so he opened his packet of cigarettes, tore off a scrap of aluminium foil wrapping, rolled it around the fuse, and pushed the whole assembly back into place. A further check on the set seemed to suggest that it was now OK.

All went well for a couple more weeks, until one night the owner suddenly became aware that a fire scene on the screen was unduly realistic. Not only could he see the flames (which were, in fact, genuine program material) but also the smoke! About the same time he became aware of the unmistakable smell of an overheated transformer.

Although he lost no time in switching off, he had a horrible feeling that the damage was done, and he rang the service department again the next morning and told them what had happened. Another mechanic duly paid him a visit, this time stopping only long enough to take a couple of sniffs at the chassis before bundling the whole thing into his truck and taking it back to service department.

WHO DONE IT?

At the inevitable post-mortem, the first question that was asked was why the fuse had not done the job it was supposed to do. When the reason for this was revealed, someone wanted to know who had serviced the set on the previous occasion. When the service record card showed that it was Mr. So-and-so, Mr. So-and-so was called in and asked some very pertinent questions.

The outcome of this interview was that Mr. So-and-so was advised that his services were no longer required and would he please collect his pay at the pay office.

A bit tough? Well, perhaps it was, and I can appreciate that any mechanic, caught without a fuse, might be tempted to make a similar improvisation.

On the other hand the firm calculated that the cost of time and components to repair the damage under guarantee was well in excess of £30, to say nothing of a lot of goodwill down the drain. (There is nothing that scares a potential customer more than a suggestion that a particular brand of set is likely to burst into flames.)

Quite apart from the fact that it was the mechanic's job to see that he had a supply of fuses on hand, and assuming that the improvisation was justified to please the customer, the least one would have expected would have been for him to fit the correct fuse at the earliest possible moment.

In the light of what actually happened, it would seem wiser not to take any chances, regardless of the circumstances.

In any case, it will be interesting to see whether fuses for TV sets become the accepted standard, or whether they will die a natural death as in the case of radios. Personally, I hope they can justify their existence sufficiently to stay with us.

And to round things off, here is a brief TV story about a 15 Kc whistle problem. Strictly speaking, I should not have had anything to do with this particular set, since it was new and still under guarantee. On the other hand I was a guest in the owner's house and could hardly refuse to at least look at the set when he asked me.

It seemed that the set had recently been delivered by his local dealer for trial and had turned out to be most satisfactory in all respects apart from a pronounced 15 Kc whistle from the EHT system. He had complained to the dealer, who had first explained that most sets suffer from this trouble to some extent and then, when it seemed that this set was worse than average, had changed the EHT transformer.

SUDDEN FAILURE

This had proved reasonably successful and the owner was quite happy until a few hours before I arrived. Then the whistle had suddenly jumped in amplitude to a condition far worse than anything he had heard before, making the set unusable. He had tried to contact the dealer, been unable to, was very keen to use the set that night, and looked upon my arrival as an answer to his prayers.

While I was happy to do what I could I was worried on two points. Firstly, the set being under guarantee, I was not keen to do anything which might prejudice the owner's claim if I was unable to fix it. Secondly, these old ears of mine are not as young as they were and 15 Kc whistles never worry me. In my business, I'm afraid this is a mixed blessing.

Still, I reasoned there was no harm in switching the set on and looking—and listening, for what that was worth. As soon as it warmed up my host advised me that the whistle was present, though faintly. The set was on a blank channel at this stage and I switched to an active one, anticipating that this would raise the frequency and make it even less obvious.

REALLY EVIDENT

Instead, my host exclaimed; "That's it. It's really bad now." But he didn't have to tell me, for even I could hear it. Strangely enough, or perhaps not so strangely, it didn't sound like a 15 Kc note to me, but more like 5Kc, and very loud, I assume that I was hearing some lower frequency component of a very complex sound.

We slipped the back off the cabinet and I studied the EHT cage. Removing the cover would have been too big a job to tackle in the circumstances, necessitating the removal of the picture tube. However, I tried pressing on the cage and then on the frame of the EHT transformer, via a hole in the cage.

(Continued on Page 49)

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PART 27 — SYNCH. SEPARATION STAGES (CONT.)

The article this month continues and concludes the discussion of synch. separation circuits. Other circuit arrangements are mentioned and the function explained of integrating and differentiating networks, connected in the output of the synch. separation valve.

THE circuit given last month, in figure 146, is a typical separator-amplifier-clipper stage, delivering positive-going synch. output pulses.

As already mentioned, some types of oscillator lock more effectively to negative-going pulses and, to obtain them, it is not sufficient merely to invert the input signal to the separator stage. The effect of this would be to make the stage, quite pointlessly, separate and isolate the peaks of "white" picture modulation.

To obtain negative-going pulses, it is necessary to modify drastically the whole operation of the separator stage, so that it will still separate out the synch. pulses but deliver an output having the required polarity.

INVERTER CIRCUIT

Figure 147 illustrates a method by which the output from a separator stage similar to 146 can be inverted in sense. The input circuit remains unchanged, incorporating a 22K resistor to minimise loading on the video circuit, an R/C combination to favour synch. information and a coupling capacitor and grid resistor to provide the necessary D.C. blocking and time constant effect.

With a composite synch. positive input signal, grid current flows through the 2.2M resistor and builds up a charge across the coupling capacitor, which holds the grid beyond cut-off for most of the time. This statement assumes that the plate voltage for the first triode is maintained at a low average figure.

Conduction only occurrs during the brief intervals when positive-going synch. pulses drive the grid from negative towards zero and beyond. The plate output therefore contains only synch. information, the video signal being suppressed.

In figure 147, the two triodes are actually connected in series, rather like the "cascode" R.F. amplifier. The plate voltage of the first triode is therefore equal to the cathode voltage of the second and this, in turn, is set largely by the potential imposed on the second grid by the resistive divider network.

The cathode of the second triode must "follow" to within a few volts of the grid potential. If it were to become substantially positive with respect to grid, plate current would be cut off and there would be no voltage drop between cathode and earth to sustain the condition.

Conversely, if it were to become substantially negative with respect to grid, plate current would increase and, with it, the voltage drop between cathode and earth. The cathode would therefore approach grid potential automatically.

CATHODE FOLLOWS GRID

As a result of this compensatory action, the cathode of the second triode (and plate of the first) must always take up a potential within a few volts of the imposed grid voltage.

As the grid voltage is reduced towards earth potential, the plate voltage of the first triode diminishes and a more severe clipping action takes place. In the circuit shown, the operating levels have been maintained rather on the high side, in order to ensure as large output as possible from the synch. separation stage as a whole.

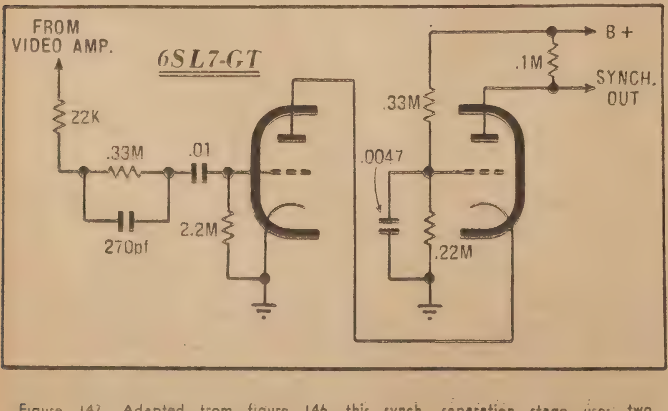

Figure 147. Adapted from figure 146, this synch. separation stage uses two triodes in series, the second being virtually cathode driven. From a synch, positive video signal it produces amplified and clipped negative-going synch. pulses.

However, whether large or small, the plate current variations of the first triode appear as a signal input to the cathode of the second. The second grid is grounded for a signal by the bypass capacitor so that this stage operates as a grounded-grid amplifier. As a result, the synch. pulses appear at the second plate, duly amplified but without any additional change in phase.

POSITIVE TO NEGATIVE

Thus positive-going synch. pulses at the input grid are separated, amplified and clipped to appear as negative-going pulses at the second grid. The same polarity is maintained at the second plate.

It will be obvious from the diagram that if, for example, only low amplitude pulses were necessary for the line oscillator, they could be taken from the first plate circuit, leaving the second to supply only frame synchronisation.

The same is true, in general, of other two-stage synch. separators, although it is necessary to remember that the pulses at the intermediate point may have different phase from those at the output and may or may not be properly clipped.

In figures 146 and 147, particular twin triodes are specified, the operating conditions being manipulated to suit them. With other valves, modifications would be necessary to the circuit constants. In the case of figure 147, higher amplitude output pulses can be obtained from the lower-mu 6SN7-GT, but only provided the video input signal is increased and the potential on the second grid re-adjusted.

VARIOUS SEPARATORS

As often as not, in practical television receivers, synch. separation is carried out, not by a single twin triode as illustrated, but by odd triode or pentode sections "left over" from other multiple valve types. For example, by using a triode-pentode as the final video amplifier, the triode can readily serve as the initial synch. separation stage, feeding another valve section elsewhere in the receiver.

As before, circuit conditions have to be manipulated to suit the characteristics but this is only to be expected.

An alternative principle which is currently being used, gets away from the two-stage clipper concept and applies a pentode type valve to achieve synch. separation. The approach would appear to have been inspired very largely by "gated beam" detectors, used in F.M. sound systems.

As in this application, grids 1 and 3

are used for control purposes and No. 2 is a screen.

The high amplitude composite video signal, synch. positive in phase, is fed to the No. 3 grid, which draws current and biases itself sufficiently to interrupt plate current, except during the positive peaks of the synch. pulses. In this respect its operation is no different from other grid-controlled separators.

It suffers the same limitation as other types of separators, in that high amplitude noise pulses can also produce grid current and, by temporarily increasing the generated grid bias, prevent the pulses from carrying the grid consistently to a slight positive potential. When this happens, pulse output in the plate circuit may be rather erratic, leading to uncertain triggering of the oscillators.

To counter this possibility, a proportion of the video input signal from the detector, synch. negative in sense, is fed to the No. 1 grid, the standing bias being set so that the synch. pulse peak just fails to carry it to cut-off. However, any signal of amplitude greater than the synch. pulse cuts off electron current, thus preventing the outer grid from building up an excess bias.

A NEW VALVE

The general principle, with variations, has been applied to the 6BE6 and to gated beam pentodes. However, a new valve, the 6BU8, has been released recently in the U.S. to provide both synch. separation and gated AGC. It has the basic grid system of a "gated" pentode, but two distinct plates, one to either side of the structure.

The output from one plate contains synch. pulses, based on the principles just explained. The other plate receives a pulse from the line output circuit and develops a standing negative bias in the manner of an ordinary gated AGC amplifier. Thus, one valve envelope performs two extremely useful functions in the receiver, hitherto involving two separate valves or their equivalent.

This new valve may very well make its appearance shortly in Australian-made receivers.

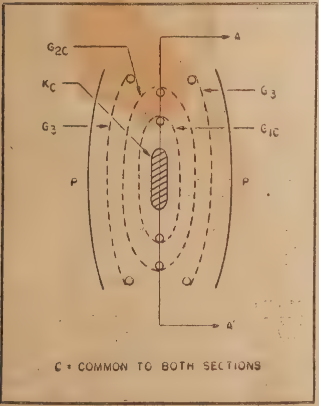

Figure 148: Here is the physical configuration of the new 6BU8 "gated beam" separator and AGC generator.

HOW "GATED SEPARATOR" WORKS

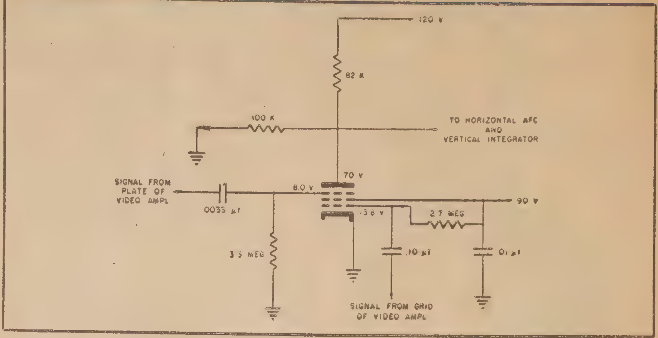
120 V
82 K
100 K
TO HORIZONTAL AFC AND VERTICAL INTEGRATOR
70 V
SIGNAL FROM PLATE OF VIDEO AMPL
8.0 V
90 V
.0033 µf
-3.6 V
2.7 MEG
3.3 MEG
.10 µf
.01 µf
SIGNAL FROM GRID OF VIDEO AMPL

Figure 149: A typical circuit for the 6BU8 separator-clipper section. Its operation is similar to that of earlier gated-beam separators

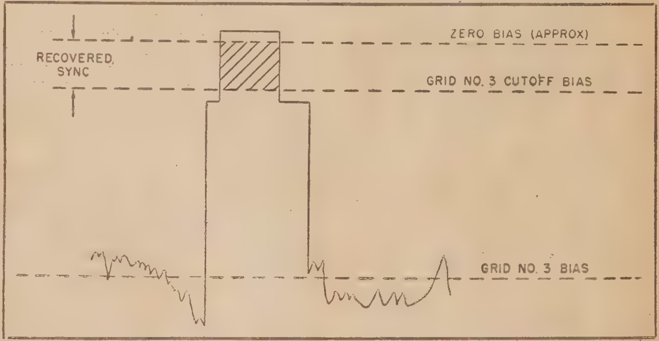

Figure 150: This diagram illustrates the normal separating action of the number 3 grid. Noise would drive the top of the synch. pulse below the zero bias line

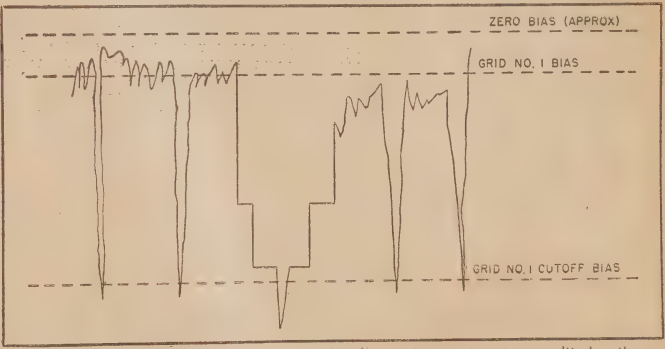

Figure 151: Noise pulses on the number 1 grid, greater in amplitude than the synch. pulse peak, cut off all electron current.

Having by such means isolated the synchronising information from the composite video signal, it is necessary to interpose here some discussion of the means by which the pulse information is itself sorted out, so that line and frame signals can be fed only and respectively to the line and frame oscillator circuits.

Figure 144, reproduced last month, showed a section of the composite video signal, including the frame block, and the sequence of pulses which would remain after the same signal had passed through the separation stage.

From previous discussion, the reader will recall that the line oscillator normally triggers on the leading edge of each relevant pulse, disregarding the half-line pulses which occur during the frame block. The fact that certain pulses which occur during the frame block are longer than others, is of no consequence to the line oscillator, though it is vital to the frame oscillator.

Separation of the line and frame pulses commonly involves the use, respectively,

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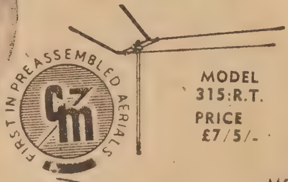

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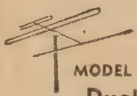

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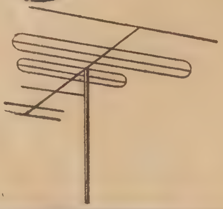

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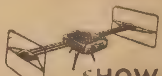

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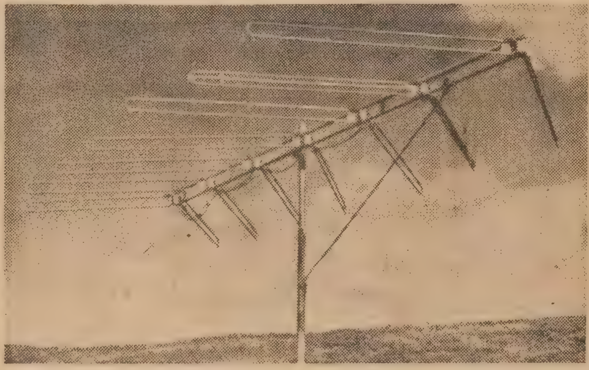

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FACTORY: CHANNEL MASTER PTY. LTD., 752 PITTWATER ROAD, BROOKVALE, N.S.W. :: XF0221 of so-called "differentiating" and "integrating" networks. Though rather imposing titles, the circuits they describe are relatively simple.

The differentiating network, which favours line synch. information, commonly takes the form of figure 152, involving a simple R/C coupling circuit, whose output is derived from across the resistor.

Circuits of this general type attenuate signals which are sufficiently low in frequency for the reactance of the capacitor to be comparable with or greater than the resistance value. Frequencies above this region are transferred without significant loss.

In other words, it is an elementary form of high-pass filter, having a "cut-off" frequency determined by the relative values of R and C.

For television work, involving pulses, it is more usual to define such circuits in terms of their time constant rather than their frequency response. With the aid of the remaining diagrams in figure 152, it should be possible to explain the significance of the term "time constant," as well as the differentiating effect on the synch. pulses.

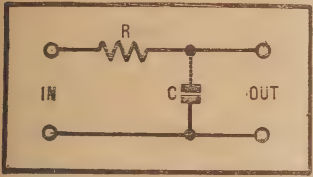

Figure 153: An integrating network, as above, is the converse of the differentiating circuit in figure 148. It attenuates all frequencies high enough for the capacitive reactance to be comparable with or less than the resistance value.

It is conventional to regard the time constant of an R/C circuit as the period required for the capacitor to reach 63 per cent of any potential applied to it through the associated resistor.

Conversely, it is equal to the period required for the potential across the capacitor to fall to 37 per cent of any initial value when discharging through the associated resistor.

Mathematically, the time constant in seconds is equal to the product of capacitance in microfarads and resistance in megohms.

A few simple diagrams will serve to illustrate the significance of time constant when dealing with pulsed waveforms.

Let us assume that a number of timing pulses (152 b) are passed through the differentiating network of figure 152a, and that the time constant of this network is kept relatively long. The pulses will be reproduced essentially in their original form except for a slope on the "horizontal" portions of the pulse and the gradual loss of the d-c component (figure 152c). This peculiarity of R/C circuits was mentioned in an earlier article.

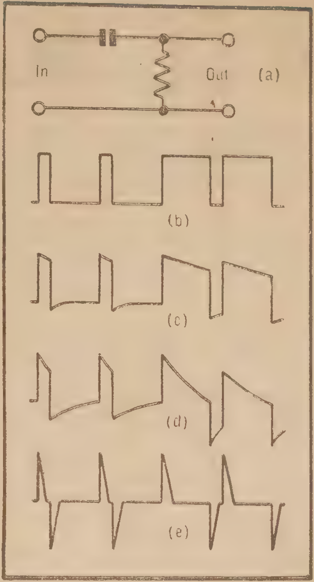

Figure 152: This diagram illustrates a differentiating circuit (a) and its effect on the pulse waveform (b) as the time constant is progressively shortened. By the time condition (e) is reached, the pulse leading edges have been reduced to distinctive "spikes".

If, now, the time constant of the circuit is reduced drastically, the pulses are immediately and severely distorted, as in figure 152d. The capacitor passes the full transient value of the first pulse to the resistor, but even though the input remains at this high potential for an instant, the capacitor cannot maintain the potential across the resistor. Thus, the voltage across the resistor has reduced considerably by the time the reverse side of the pulse is encountered.

This trailing edge actually carries the voltage across the resistor into the negative region and a period of discharge follows while the input voltage remains temporarily on the zero line.

On the longer pulses the voltage across the resistor has virtually disappeared before the trailing edge is encountered. Under these conditions the negative-going trailing edge carries the voltage across the resistor well into the negative region, so that the rectangular pulses are transformed into a roughly triangular shape.

If the process is carried still further the time constant can be made comparable with the duration of the shortest pulses. When this occurs (figure 152e) the leading edges of all pulses are transformed into sharp positive-going spikes, while the trailing edges become negative-going spikes of similar magnitude.

The negative spikes normally have no significance in the operation of the time base, the positive-going spikes being the ones utilised for synchronisation.

THE RIGHT INTERVALS

It follows that if the leading edges of the pulses are properly spaced, as is indeed the case, then the positive synchronising spikes will occur at exactly the right intervals for line synchronisation, carrying no hint of the actual duration of the initiating pulses.

During the interval where the pulse rate is doubled for the equalising purposes, there are twice the usual number of positive spikes, but only the alternative ones will trigger the oscillator.

In practical receivers, there is no great consistency in the choice of time constant for the differentiating components. It would often appear to be longer than one would expect, or, conversely, it may be found considerably shorter, the components having been chosen so as to attentuate the line pulse deliberately to some desired lower amplitude.

However, without enlarging upon factors which might influence the precise choice of components, it is usual to find

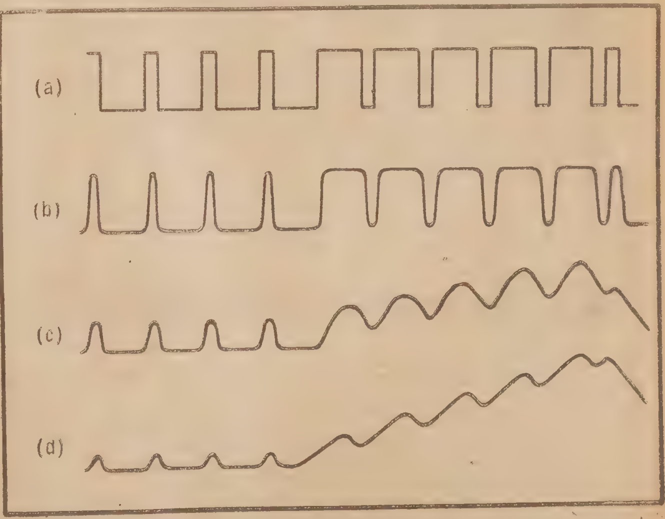

Figure 154: When a train of pulses (a) is passed through an integrating network, the progressive effect of increasing the time constant is shown in b, c and d. Note that the line pulses are attenuated but the energy in the longer frame pulses builds up into a large triangular pulse.

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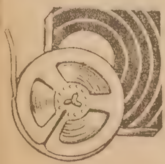

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a short time-constant "differentiating" network feeding the horizontal oscillator or its frequency control circuit—a subject which has yet to be discussed.

In some cases the frequency control circuit may require two balanced synch. pulses giving a simultaneous positive and negative excursion. In such cases, the line pulse, after differentiation, may be passed through a phase inversion or phase splitting stage, to give what is virtually a "push-pull" synch. pulse.

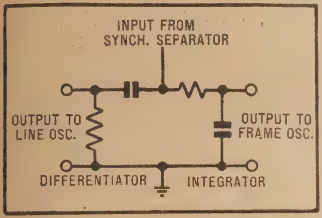

Figure 155: A composite differentiator and integrator circuit having, respectively, a short time constant and a long time constant.

An integrating or "adding" network is complementary in its function to a differentiating circuit. It usually takes the from of a resistance-capacitance network, but with the output taken from across the capacitor, as illustrated in figure 153

It attenuates frequencies which are sufficiently high for the reactance of the capacitor to be comparable to or less than the resistance value. Frequencies below this region are transferred without significant attenuation so that it is, in effect, a simple form of low-pass filter.

With suitable constants, circuitry of this same configuration is often encountered in audio practice to attenuate the higher frequencies, producing treble loss.

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A few weeks ago, Mr. J. Croker of Stafford, Brisbane decided to build our 17-inch TV receiver—his first set of any kind.

When completed, he loaded it in his car and brought it to Sydney for the weekend, because there is no TV service, as yet, in Brisbane. The set worked immediately, the only complication being a back-to-front picture through inadvertent reversal of the line scan leads.

Back in Brisbane, later, the set was peaked up and checked at the Radio Section of the Central Technical College.

Mr. Croker then took it home, connected it to an aerial and was greeted by a description from Melbourne on Channel 2 of the Farnsworth Air Pageant. The programme, received by anomalous propagation effects, was followed for 1½ hours.

Good hunting, Sir! Jolly good hunting!

Figure 154 illustrates the effect of passing a train of television synch. pulses through such a network.

Diagram 154 (a) shows a series of brief line pulses leading into five long pulses, the latter forming the frame synchronising block. This is how they would emerge from an idealised synch. separation stage.

If fed through a network showing only a slight amount of high frequency attenuation, the high order harmonics would be removed, rounding the corners and imparting a slope to the hitherto vertical sides of the pulses. See diagram (b).

If the time constant of the network is lengthened still further as in (c), the effect on pulse shape is profound. On the shorter pulses, the output voltage has not time to reach maximum amplitude before the downward pulse is encountered. As a result, the line pulses are severely rounded off and attenuated.

On the longer framing pulses, the same slow rise time is evident but, because of their longer duration, the voltage approaches maximum before the downward excursion is encountered.

In point of fact, an additional effect becomes evident. The charge across the capacitor rises during the first long pulse, commences to fall at the end of the pulse but fails to reach zero before the next long pulse arrives. The energy from the second pulse adds to what is left from the first, so that an accumulative action takes place—hence the term "integrating" circuit.

EFFECT OF TIME CONSTANT

If the time constant is made long enough, the effect is as illustrated in figure 154 (d), where the integrating network has substantially attenuated the line pulses and built up a rising wavefront from the frame block. Since the charge diminishes rapidly after the last long pulse has passed, the frame synch signal is roughly triangular in shape.

In other words, an integrating network performs the vital function of changing frame synch. pulse information from a time to an amplitude basis and the change in amplitude can be utilised to trigger the frame oscillator.

Figure 155 shows a composite differentiating and integrating network taking input from the synch. separator and diverting it respectively to line and frame oscillators.

The type of pulse produced by a simple integrating network is not ideal for frame oscillator triggering. In the first place, its leading edge slopes markedly over a time interval equal to 2½ lines.

If there is any uncertainty as to where along the slope the frame oscillator will trigger, line interlace must be prejudiced. In point of fact, acceptable interlace demands an accuracy of the frame oscillator equivalent to much less than one half-line.

A further complication is that no feasible integrating network can give complete attenuation of the line frequency energy. Therefore, the slope of the integrated pulse will contain slight half-line notches, which may aggravate any tendency to uncertainty in the frame triggering.

Some receivers use a double integrating circuit to gain some slight advantage. Instead of a single resistor and capacitor, two resistors are used in series, with the junction and output end separately

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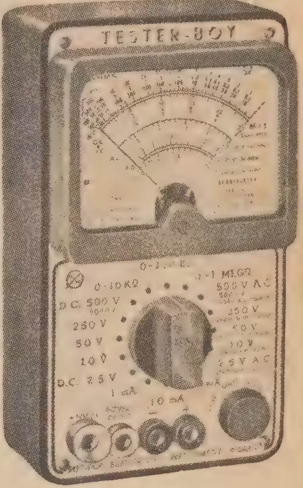

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bypassed with suitably chosen values of capacitor.

With care along these lines, acceptable if not perfect frame triggering and interlace can be obtained.

In point of fact, one of the main hazards to interlace in a conventional television receiver arises not from any limitation of the integration circuitry, but from leakage of energy from the line-scan circuits to the frame oscillator input. This calls for careful layout and shielding of critical leads and components.

Occasionally, the reader may come across circuits in which a good deal more complication surrounds the differentiating and integrating networks.

For example, the separated pulses may be fed through two initial networks to separate pulse amplifier valves, one having short time-constant components throughout, the other long time-constant, with a view to further separating, amplifying and clipping the line and frame synch. information.

FRAME PULSE ALONE

Again, the frame pulse alone may be further amplified and clipped, with a view to making its front edge more steep and therefore less ambiguous as a triggering signal.

Still further schemes avoid integration of the frame signal altogether, amplifying the frame pulses instead of having them rise progressively above some reference potential. The idea is that the frame oscillator shall trigger on a particular pulse in the frame block for each field.

It would appear that these special circuits are more common in English receivers than elsewhere, possibly for the reason that their less elaborate transmission standards make it difficult to obtain satisfactory interlace from a simple integrating frame pulse circuit.

SERVICEMAN WHO TELLS

(Continued from Page 41)

As soon as I pressed the frame, the amplitude dropped and could be made to vary up and down and adopt almost any level as long as steady pressure was applied. The whole thing seemed extremely touchy.

There was still not much hope that I could help, and I was about to stage a gracious retreat when I noticed a single assembly nut on the transformer frame which I could reach with a pair of long-nose pliers. My host produced such a device, and I reached through the hole and gripped it.

It wasn't exactly loose, but I found I could get approximately half a turn out of it without effort, and about another quarter turn with some extra force. The effect this had on the whistle was quite startling, taking it right out of my hearing with the first half-turn and, according to my host, reducing to virtually nothing as I finished tightening it.

And so, by the merest chance, I was able to reach and tighten the one nut in the whole assembly which was causing the bother. It probably wouldn't happen again in a hundred such cases.

Naturally, my host was jubilant, and quite prepared to give me all the credit, in spite of my explanation about the lucky chance.

In the circumstances, who was I to contradict him?

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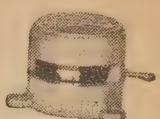

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T1/4	60M 6.3V 5V 285V
T1/16	60M 6.3V 5V 385V
T1/8	80M 6.3VCT 6.3V 5V 285V

Type No.	Description
T1/20	80M 6.3VCT 6.3V 5V 385V
T6/18	100M 6.3VCT 6.3V 5V 285V
T6/26	100M 6.3VCT 6.3V 5V 385V
T6/20	125M 6.3VCT 6.3V 5V 285V
T6/28	125M 6.3VCT 6.3V 5V 385V
T6/22	150M 6.3VCT 6.3V 5V 285V
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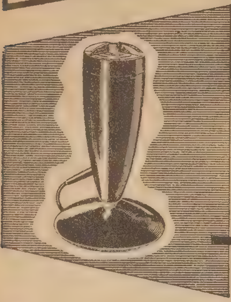

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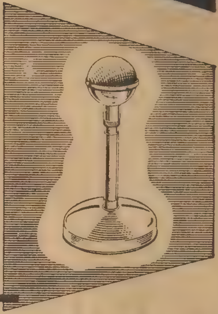
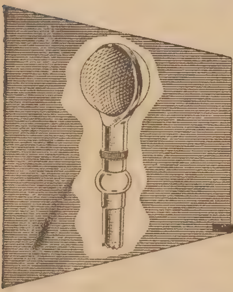


TABLE or STAND MICROPHONE, MIC22

This omni-directional Microphone is robust in construction, with a pleasing appearance Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost. **PRICE, £9/18/6.**



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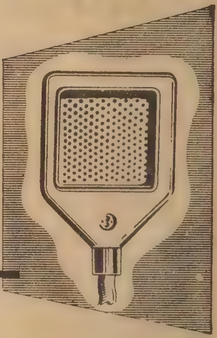
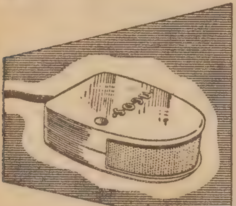


LAPEL MICROPHONE, MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft, moulded-rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel. **PRICE, £5/19/6**



GENERAL PURPOSE, MIC35

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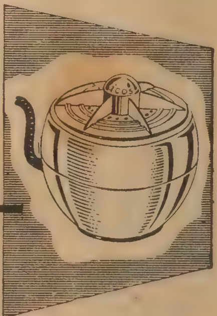
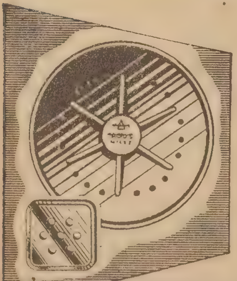


HAND or DESK MICROPHONE, MIC33

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s **PRICE, £6/18/6.**



(MIC32 illustrated)
(MIC23 illustrated)

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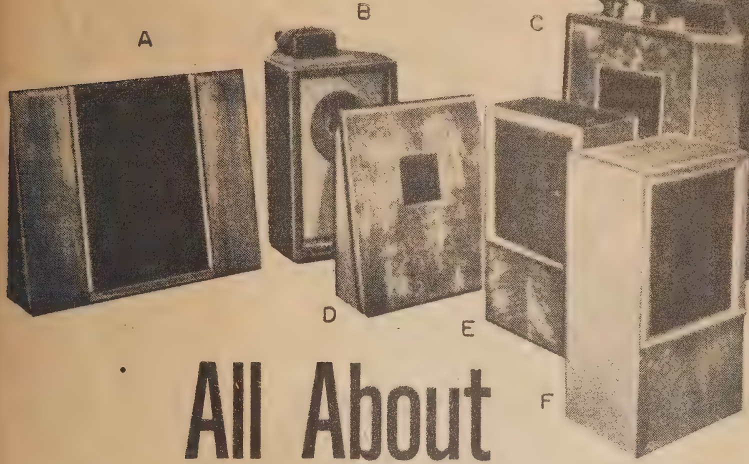

All About Audio and Hi-Fi

Room Resonance & Stereo

By
G. A. BRIGGS
Managing Director Wharfedale Wireless Works Ltd.

Fig. 1. Photograph of speakers outlined in Fig. 9 (A) Three-speaker system used in tests described in Part 2. (B) "Super 12" in Electro-Voice "Aristocrat" cabinet. (C) Three-way corner system. (D) Ten-inch speaker on sand-filled 28" x 24" baffle. (E). (F) Ten-inch speaker in 2 cu. ft. bass-reflex enclosure with acoustic filter.

Part 3. Observations on reducing room resonances and providing 2-channel sound with multiple speakers.

IT seems to me that the excellent results obtained from the two-channel operation are, to some extent, due to the use of two loudspeakers which break up room resonance; therefore, similar room control can be achieved with single-channel output. I would not say that this is half-way to stereo, but I think we could label it "demi-semi stereo."

The main difficulty (at least to my ear) is with solo items, as it is rather disconcerting to hear two Victoria de Los Angeles instead of one; but judicious orientation of the extra speaker, e.g., toward a corner, overcomes objectionable directional effects.

BACK TO BACK IS GOOD

A back-to-back set-up also gives excellent results with simple radiators.

Some months ago I heard a demonstration of the Philips "Novosonic" system at Century House, London, and I was greatly impressed by the way in which room resonance was overcome by the judicious placing and spacing of one bass enclosure and two treble speakers working with a crossover at 300 cycles.

Added to this, our technical director, Mr. R. E. Cooke, recently returned from Denmark with his head all full of new and interesting ideas and developments. Now the main purpose of Mr. Cooke's visit was to spend some time with my friend, David Hall, formerly music director, Classics Division, Mercury Record Corporation, U.S.A., who was lecturing at the University of Copenhagen.

I was most interested to learn that David Hall listens, at home, to several speakers at a time in order to overcome room resonance, two of them being reflex cabinets with an acoustic filter similar to the units shown in Fig. 1 and 3. One is placed under the grand piano and the other under a desk. I quote Mr. Hall as follows:

"The reflex cabinet in the desk kneehole is the thing for good bass, especially since the desk is very heavy and does not resonate."

I attach great importance to what he does, for the following reason:

Prior to our first Carnegie Hall demonstration in 1955, I was anxious to have some guidance as to which American records would suit the hall (Carnegie, not David!).

Mr. Hall gave us a list of some 30 records of various makes, and when I later compared the program with this list I was amazed to find that every commercial record used had been recommended thereon. This shows almost uncanny knowledge of acoustics and the effects of recording and reproducing characteristics.

As a result of these and similar experiences, I have carried out a number of listening tests at home, which I will now proceed to describe. My yardstick for judging reproduction is a very simple one: the arrangement which sounds least like listening to loudspeakers is the best.

It is necessary to include another plan of my own listening room to show the disposition of the half dozen speakers used in the tests (See Fig. 2).

TEST SPEAKERS

A photograph showing all the speakers assembled in a corner of the room is reproduced in Fig. 1. I have already explained that Mrs. Briggs is case-hardened, but before readers start sending her letters of sympathy I must add that the present conglomeration of speakers is unusual, even for me.

The speakers used in the test were Wharfedales, but the findings would hold true with any reasonably good specimens of any make.

In fact, a potent argument in favour of the use of two speakers of different size and shape is that inequalities tend to be smoothed out.

It is obvious that if you have a cabinet speaker which honks a bit in the bass, and you add an open baffle speaker in parallel, you reduce the honking by about half. As we have already agreed that room honking is reduced, we seem to be approaching the millenium of double loudspeaker demand.

Even the rather boxy tone of the average radio set can be improved by simply adding an external speaker with no cabinet or baffle, thus removing half the sound from the box or resonator.

The speaker units are shown externally in the diagram to indicate the direction in which they were facing. Any speaker could be switched on or off at will. My general opinions are as follows, but other rooms would produce different results.

GENERAL OPINIONS

1. Two speakers are much better than one, but three are only slightly better than two on large works. More than three not worth the space used.

2. Speakers A and C gave the best results on chorus, orchestra and organ. Then A and B, then B and C, then C and D.

3. Speakers C and D were best on solo items, and very satisfactory on everything. Probably the best all-round acoustic setup.

4. Speakers B, D, and F facing towards the left could be added to A, C, or E without producing disembodied effects on solos, and yet with beneficial results on all types of music.

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5. Speaker B being very sensitive and directional was always preferred not facing straight into the room. Improved transient response from the high-flux magnet system could be heard when this "Super 12" came on.

6. The piano always sounded best with open mounting associated with A, C or D. Cabinets like B, E, and F give a slightly "boxed-in" effect on this instrument. Speaker A alone was better than B and E or E and F together, but a cabinet/baffle combination was very good.

7. Baffle D with reflex cabinet E was better than the two cabinets E and F on practically all types of music.

8. Cabinets E and F were preferred standing back-to-back.

9. Most cabinet speakers used singly, other than corner models, give best results when pointing toward a corner or at an angle of 45 degrees to a hard wall, so that the sound is splashed into the room.

TRY PHASING

10. With two speakers, phasing often makes a big difference in the results. Always try reversing the leads to one speaker. In some positions, out-of-phase connection will be best.

11. For optimum bass, side-by-side (in-phase) placing is obviously best, but this arrangement is the least effective in killing room resonance.

No doubt many readers already possess a spare loudspeaker which could be mounted on a baffle and pressed into service for experiments on the lines indicated. Unlike stereo, equal sensitivity is not necessary, but the extra unit must at least be loud enough to make its presence felt to some extent.

Baffle D used in these tests was made from two sheets of ¼in plywood 28 x 24 inches with a ½in layer of sand between them. Two side pieces in ½in plywood 9in wide at the base and narrowing to 4in at the top support the baffle and provide a reasonable backward slope. The associated speaker unit should have a cone resonance below 40 cps for satisfactory performance.

REFLEX CABINET

Although a simple baffle is recommended for the second speaker in these tests, and the size described gives very good results with a suitable 10in unit, of the two I still prefer the reflex cabinet with acoustic filter for single speaker use on most types of program material. For one thing, there is more "beef" in the bass.

As the domestic use of two-channel recording and reproduction appears to have made more progress in America than in Great Britain, I will confine my remarks to the expression of a few opinions which I have formed on the experience I have had so far.

I am firmly of the opinion that the undoubted step forward in natural reproduction, which is possible with two channels, is due to sweeter top and fuller and rounder bass rather than to true stereophonic effects.

When I hear the woodwinds in an orchestra I am concerned (a) with what they play; (b) with how they play it; and (c) with how it sounds. I am not the least bit interested in where they sit.

I agree that some stereo recordings used with directional loudspeakers, correctly placed, give very lifelike results to listeners also correctly placed.

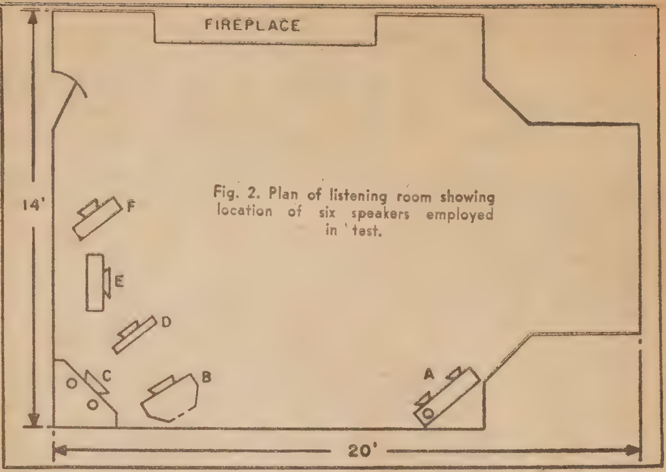

Fig. 2. Plan of listening room showing location of six speakers employed in test.

We played a couple of H.M.V. "Stereosonic" tapes (7½ ips) in the Royal Festival Hall, London, in May, 1956, and my estimate is that about 1,000 people out of 2,500 heard something far superior to the best we did with single-channel tape at 30 ips, but the remaining 1,500 heard something unbalanced and unsatisfactory.

Admittedly, the difficulties are far easier to overcome in small rooms (three channels are really necessary for large halls), but placing two loudspeakers and, say, half a dozen listeners ideally in a fully furnished room is not easy.

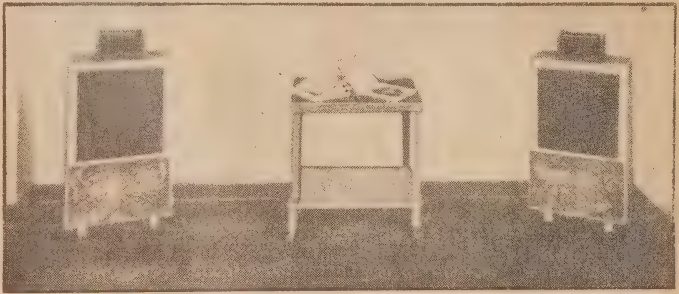

Fig. 3 Photograph of two speaker systems used to demonstrate two-channel sound

But if we forget stereo and use omni-directional loudspeakers we can have some glorious sound and sit where we like!

Mr. A. R. Sugden, of Brighouse, Yorkshire, has given convincing demonstrations on these lines, and we demonstrated "Stereosonic" tapes at the 1956 Audio Fair in London, using the speaker systems shown in Fig. 3. (The tweeters face upward.)

These views received strong confirmation recently when Allen E. Stagg, manager of International Broadcasting Company, London, played for me some two-channel orchestral recordings just made with a newly acquired Ampex 300 machine (speed 15 ips). No special attempts at stereophonic depth had been made — in fact, the microphones were placed above the orchestra — with the result that excellent sound could be heard irrespective of the location of the listener.

One of the main virtues of two-channel operation is that studio and listening room coloration is reduced to a minimum. Also, in view of the ever prevailing difficulty of achieving perfection, "two channel" is a safer and sounder cognomen for the whole system than "stereo."

Even movie houses which went over to three-channel stereo with such a bang a few years ago, seem to be slipping and merely piping doctored sound levels into the various channels. I suppose they have decided that good stereo will not replace a good story.

(To be continued)

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Here's your answer, Tom!

This month we had a mixed bag of queries. Although of a general nature, several are based on Frequency Modulation which seems to have aroused a great deal of interest in recent months. We trust that readers may be able to glean some useful information from those we have selected for these pages.

In your October issue you published the circuit of a 2in CRO and suggested the use of magnetic shift. However, the cathode-ray tube that I intend using has no magnetic shift. Must I use the potentiometers and, if so, how?

The suggestion to which you refer Tom, was made to save the use of potentiometers as shift controls. It was suggested that permanent magnets be placed above, and to the side of the tube so as to enable one to centre the spot and hence the pattern on the screen.

The usual arrangement to provide this facility is to place potentiometers in the voltage divider network of the EHT supply and to vary the standing potential on one of each pair of deflector plates by means of these potentiometers.

Varying the potentials on the deflector plates will tend to pull the electron beam and hence the spot, up or down or to either side, depending on the deflector plates involved.

An external magnetic field will have much the same effect on the electron beam, hence the suggestion regarding the use of external magnets.

* * *

I remember having seen the Peltier Effect mentioned in a technical article. Could you tell me what it means?

The Peltier Effect is a thermo-electric phenomenon occurring at the junction of two dissimilar metals. If a current is passed from one metal to another, heat is produced at the junction, conversely if the junction is heated a voltage is produced.

The thermo-couple is a well-known example of this latter effect, and is commonly used for radio and other applications.

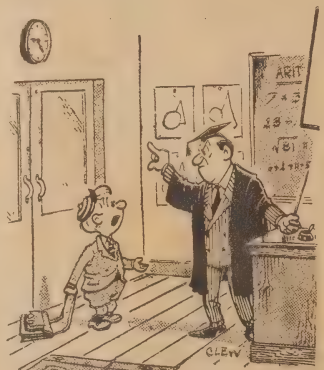
When radio frequency current is passed through a thermo-couple, it causes a rise in temperature, due to the resistance of the fine wires involved. This rise in temperature creates a potential between the wires, sufficient to deflect a sensitive DC meter movement. It is only a matter of calibration to have the meter read directly in terms of RF amps, and this is the basic principle of the usual RF ammeter.

The temperature of an object or system can likewise be measured electrically by exposing a thermo-couple to it and noting the potential which it produces.

What type of fixed capacitor has the least resistance?

If we wished to be facetious, Tom the answer would undoubtedly be "a short-circuited capacitor." However, you are undoubtedly referring to undamaged specimens.

Actually it is not the job of a capacitor to exhibit any resistive qualities, its prime function being to have . . capacitance. Nevertheless, since there are no perfect insulating or dielectric materials, capacitors do show some parallel resistance and this is notably true of the electrolytic type.



"The story you are about to hear is true — only the names have been changed to protect the innocent!" —"TV TIMES"

Typical electrolytics may show a D.C. resistance between terminals of anything from a few thousand ohms to a megohm, depending on their capacitance value, their condition, how recently they are used and which way round they are connected to the multimeter.

Generally speaking, paper capacitors should have a leakage resistance of well over 500 megohms while mica and ceramic capacitors will have leakage values well in excess of 1,000 megohms.

From the foregoing it is obvious that it is useless to assess the condition of a capacitor with an ohmmeter having the usual ranges. Although some leakage can be tolerated in most circuit applications, excessively leaky capacitors may still have a leakage resistance outside the range of the ohmmeter.

* * *

Is it necessary to have trimmers on variable capacitors?

No Tom, it isn't strictly necessary to have trimmers on variable capacitors. It is frequently more convenient to mount them in this position but they may just as well be mounted under the chassis. The main requirement is simply that they be connected in parallel with the tuned circuits.

The purpose of trimmers is to allow the total capacitance across the tuned circuits in a receiver to be balanced, so that they can all be tuned to the same frequency, at least with the ganged capacitor in its near open position.

Balancing or "tracking" with the gang plates in mesh depends more on the accaracy of the gang sections, the coils and the settings of the adjustable cores which are normally fitted to modern coils.

* * *

What is photo-conductivity?

Photo-conductivity is an effect exhibited by certain substances in which their electrical resistance varies with the intensity of the light falling on them. Selenium is such a substance.

If a selenium cell is connected in series with a source of voltage and a sensitive microammeter, and light is directed at the cell variations in current flow will take place as the light is varied.

As the intensity of the illumination is increased the resistance of the cell will decrease. Conversely as the light source is decreased, the resistance of the cell will increase until it is maximum when the light is zero. This is termed the 'dark resistance" of the cell.

In point of fact, Tom, selenium is so responsive to light that it can be made to develop an actual potential without the use of a battery. This principle is put to everyday use in the ordinary photographic exposure meter.

Under normal condition photo-conductive cells are very sluggish in their response to light variations, being slower in one direction than in the other.

* * *

How do the plates of a twin diode receive high tension in the circuit of a ratio detector or discriminator in an FM receiver?

There is no question of any high tension ever reaching the twin diode in a discriminator circuit, as there is no high tension flowing in the secondary of the discriminator or ratio detector transformer.

The primary winding is the one which carries the plate current for this stage. Signals built up across the primary are transferred to the secondary through mutual induction. The discriminator circuit virtually converts the FM signal into an AM signal which is demodulated with the aid of the diode.

There is no more reason to have B-plus on discriminator diodes than on the diode detector in an ordinary AM receiver.

* * *

Would it be possible to use a one valve FM detector with a pair of headphones and without a discriminator transformer and the preceding stages?

We shall have to disappoint you Tom. but a diode circuit will not usefully demodulate FM signals without the aid of a ratio detector or discriminator transformer.

We have heard of old-style super-regenerative receivers being used to receive FM signals but, by and large, the FM system does not lend itself to simple receivers like AM.

* * *

What is magnetic hysteresis and what is hysteresis loss?

Magnetic hysteresis is a phenomenon occuring in some magnetic substances when the growth and decay of the magnetic flux is unable to keep pace with the source producing this flux.

An example is the flux in the core of an electromagnet. The flux takes a certain time to build up after the current is switched on, the time lag depending on the magnetic hysteresis of the particular substance used for the core.

Hysteresis loss is a form of energy loss and occurs whenever a magnetic substance is subjected to varying magnetising forces. The greater the magnetic-hysteresis effect of the particular substance used, the greater the hysteresis loss.

* * *

What is the purpose of a limiter stage in an FM receiver?

A limiter stage is used to produce a signal at its output which becomes substantially constant in amplitude, once the input signal exceeds a certain value.

The limiter does this by the simple procedure of being easily overloaded. Its plate, screen and bias voltage are adjusted so that it can only give a certain amount of output voltage, no matter how much signal it receives. Since the design of the set ensures that it is overloaded by any almost useable signal, all signals delivered from it are at a constant amplitude.

Noise pulses are "clipped" or "limited" along with the excess signal.

* * *

I have seen the term magnetic flux used considerably and I am aware of its significance. However, the other day I came upon the term "Light Flux." Is this correct?

Yes, Tom, the term is quite correct and is used to measure the quantity of light energy passing through a certain area. The light flux passing through this area will depend on the light intensity of the source and the distance of the area from the source.

The unit of light flux is the lumen and is defined as the total light energy passing through an area of one square foot placed at a distance of one foot from a standard candle.

* * *

I have seen the words leakage inductance used when referring to output transformers. What does it mean?

The leakage inductance of a transformer is the inductance which may be considered to exist between the primary and secondary of a transformer, due to a failure to achieve complete coupling between the two windings.

If it were possible for all the flux produced by the primary winding of a transformer to cut all the turns of the secondary winding then the leakage inductance would be zero. However, although the leakage inductance of modern good quality transformers is very low, it nevertheless exists and its effect is much the same as would be produced if an inductor were connected in series between the secondary of an imaginary perfect transformer and the load.

Leakage inductance usually produces a falling off in secondary voltage as the frequency of the primary current is increased. The "cut-off" frequency beyond which the output falls rapidly, depends on the value of leakage inductance and the terminating resistance.

* * *

What causes image interference and double spotting?

Just for the record Tom we had better inform you that double spotting is just another name for image interference.

Image interference can occur only in a superhet receiver and is incidental to the fact that the intermediate frequency is produced by beating together the incoming signal with one produced by a local oscillator.

Taking an example, we will say that you wish to receive a station 1500 Kc on a receiver having a 455 Kc IF channel. The set will have to be tuned to the high frequency end of the band until the signal circuit is resonant at this frequency. The oscillator will then be tuned to 1500 Kc plus 455 Kc which equals to 1955 Kc.

However by tuning the set to the other end of the band a position will be reached where the local oscillator is reduced to 1500 Kc, minus 455 Kc which equals 1005 Kc. At this frequency the same station may be tuned in, provided the signal is strong enough to burst through the signal circuit, which is not now tuned to it.

This second point of reception is known as the image and is characterised by being displaced from the correct reception frequency by twice the intermediate frequency.

Image reception is seldom encountered in a 455 Kc broadcast band superhet, because the signal tuned circuit or circuits can readily reject an image which is 930 Kc away. However, on the short-wave bands, a difference of 930 Kc is only a very small percentage of the signal frequency and the signal tuned circuits cannot reject the image at all well. As a result, it is common to have strong stations coming in at two points on the dial.

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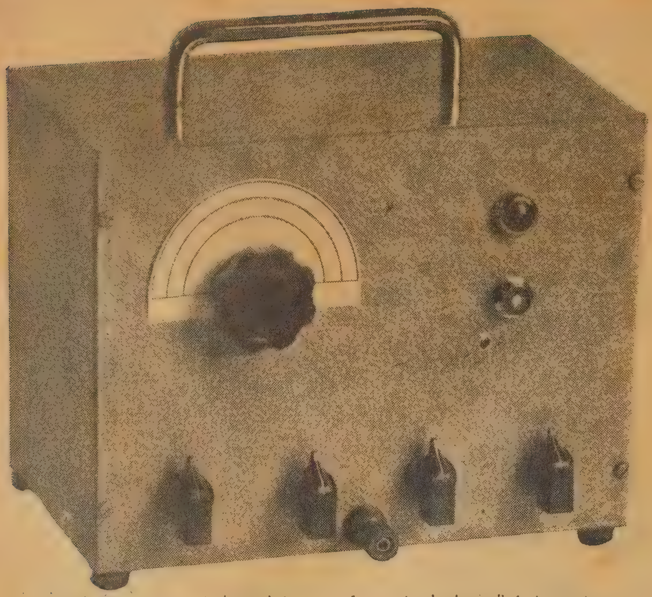

The complete instrument is housed in one of our standard small instrument cases, and we are hoping that an etched label will be available for it shortly. The controls, left to right are: Horizontal bars, Function switch, attenuator, and vertical bars. The large knob is the tuning control and the RF outlet is on the right.

A Simple TV Pattern Generator

The advent of TV has created a demand for a whole new range of test equipment, and we hope to describe "do-it-yourself" versions wherever this appears practical. Here is a description of a pattern generator which will prove invaluable in the adjustment of receivers, yet which is simple enough for any experienced enthusiast to construct in a few hours.

by Philip Watson

THIS is the second piece of TV test equipment we have described, the first being the Sweep and Marker Generator of March and June, 1957. Just how far we can go in this field remains to be seen, but even these two will provide a worthwhile addition to your workshop.

OBVIOUS NEED

The need for a pattern generator will be obvious to anyone who has ever attempted to adjust deflection circuits for optimum deflection and linearity. These two functions are very largely interdependent, the adjustment of either one affecting the other quite markedly, and necessitating the careful balancing of one against the other.

The first thing that one learns when attempting this operation is that ordinary program material is virtually useless, at least as far as linearity adjustments are concerned. Even though the effects of severe non-linearity may be painfully obvious when viewing the program, the varying nature of the picture makes it extremely difficult to correct this, except in a very general way.

Far better results can be obtained when working from a fixed pattern, such as the test patterns transmitted by the TV stations, particularly if they include equally spaced horizontal and vertical lines.

Unfortunately, there are two major objections to these patterns. One is the fact that a suitable one is seldom available exactly when it is required, or that it may be turned off at any time — often right in the middle of a critical adjustment.

The other is that these patterns are not always completely above reproach themselves. After all, they are transmitted by means of a conventional scanning raster, and which is subject to exactly the same linearity problems as found in the receiver.

To be sure, one would expect that the transmitter would be capable of higher standards than found in many receivers and, in general, this is true. However, it is equally true that there are noticeable differences between stations, or even from the same station at different times, suggesting that transmission engineers also have their troubles.

Thus there arises the need for some standard which is completely above reproach; as well as being readily available whenever, and for as long as, the operator may require it. This is the role of the pattern generator.

TYPICAL PATTERNS

It normally provides (1) a series of vertical lines, (2) a series of horizontal lines, (3) a combination of these two, making a "cross hatch" pattern, and (4) a dot pattern. This last is optional and only required when, and if, we have colour TV.

The number of lines available, either horizontally or vertically, may be varied over a reasonable range, thus extending the usefulness of the final pattern.

The instrument couples into the aerial terminals of the set, a simple R.F. generator being modulated with the various bar patterns as required. It is normally capable of being tuned to any of the assigned TV channels. Thus, in a general way, it also checks the overall performance of the receiver.

This is a broad general picture of the pattern generator and what it is expected to do. When we come to consider the design and construction of such a unit, several problems and possible solutions present themselves.

The bar pattern generators do not, in themselves, present any serious problems. They usually consist of simple multivibrator circuits operating at some suitable multiple of the frame frequency (for horizontal lines) and a similar multiple of the line frequency (for vertical lines).

IDEAL WAVE-SHAPE

The characteristic multi-vibrator waveform, with its long period of inactivity and short pulse at the commencement of every cycle is ideal for the purpose, the inactive period producing the black space between bars and the short pulse the narrow bar itself. By varying the frequency of the oscillator, relative to the line or frame frequency, the number of horizontal or vertical bars may also be varied.

The R.F. generator is also fairly straight forward, since it is neither a fre-

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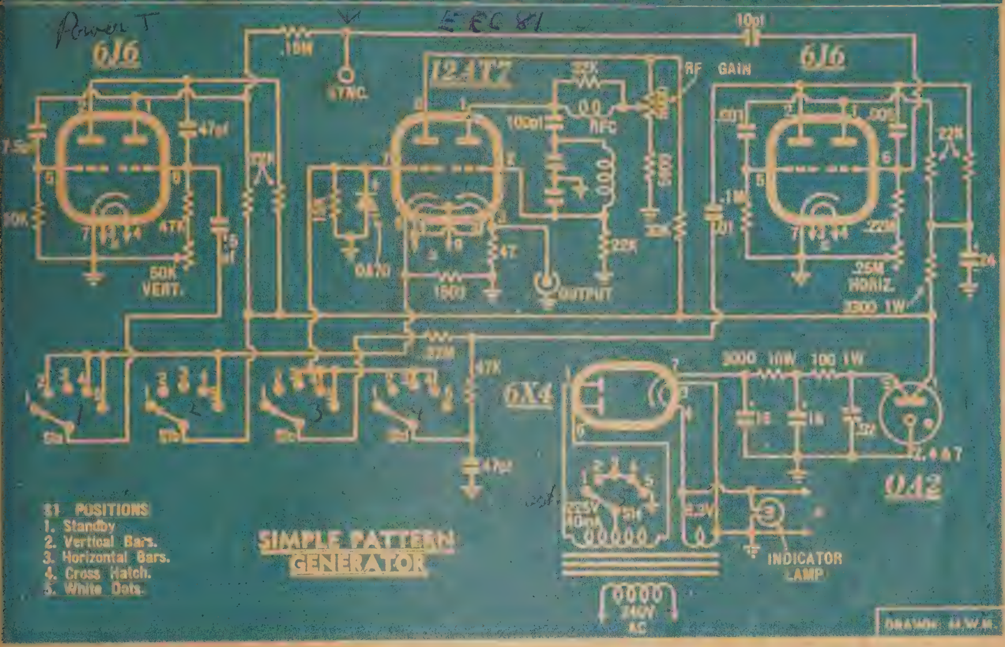
CIRCUIT DIAGRAM OF TV PATTERN GENERATOR



Main points of the circuit are the two 6J6's as multi-vibrators, and the 12AT7 as RF oscillator and modulator. The variable pot in each grid circuit controls the number of bars on the screen. Note the synchronising terminal into which energy from the receiver yoke is fed.

quency or a sensitivity standard. As a result, elaborate precautions to minimise leakage and frequency drift are hardly justified.

The hard part concerns the provision of synchronising pulses. Ideally, such a generator should generate a complete set of line and frame synchronising pulses, exactly as in a TV transmitter or, at most, dispensing with the refinement of interlace.

This arrangement is used in the better class commercial instruments and results from it are excellent. The snag, of course, is the complexity involved, a typical commercial instrument having 14 separate valve functions, with appropriate circuitry.

NO SYNCH PULSES

At the other extreme a very simple instrument may generate no synch pulses at all. In this case, synchronisation may be largely a matter of luck, particularly as regards the vertical bars. The general idea is that a portion of the black space between the bars may have enough amplitude to force its way through the synch separator and be interpreted as a synch pulse, and that the one occurring nearest to the natural firing time of the deflection oscillator will be selected by the set.

This is leaving a lot to chance, and much appears to depend on the characteristics of individual sets. Some will synchronise easily, others are cranky, and others, again, are completely hopeless. All things considered, such an arrangement does not seem to be a very good one.

However, there is a worthwhile refinement of the above arrangement. If a small amount of deflection energy from the TV set is picked up and fed back to the generator, the latter will be synchronised by the TV set, rather than the other way round. The result is virtually the same, and the vertical bars may be locked easily and positively by this method.

The horizontal bars present a somewhat different problem. These do not tend to break up, as do the vertical bars, but simply roll in the same manner as an unlocked frame. If some of the yoke energy is also fed to this oscillator, it will tend to lock it also, though not as positively as in the case of the vertical bars. It may sometimes call for careful adjustment of both the receiver and generator controls in order to obtain a stationary pattern.

FRAME PULSES

A further refinement would seem to be the provision of simple frame pulses within the generator to improve this function, while still relying on the line pulses from the receiver for vertical bar stability. If successful, such an arrangement could produce excellent stability while retaining the advantages of essential simplicity.

In fact, we have already conducted a number of experiments along these lines, and the results appear quite promising. However, it is clear that the scheme will take longer to develop that we can devote to it at the moment, so we will have to leave it for another issue. Even without it, the generator is still extremely useful.

The circuit we have used for this instrument is based on an overseas design, brought back by the editor during his recent overseas tour. During that tour, and while in the U.S.A., he visited the Heath Company, marketers of the well-known Heathkit test instruments in simple home construction kit form.

SIMPLE INSTRUMENT

He was particularly intrigued by a simple pattern generator they had developed and the company very kindly made available a sample kit and all the neecssary instructions. We built this up, made it work under local conditions, and then set about building a version around components readily available on the Australian market.

It is this second model which we describe here. It differs physically from the original but the electrical circuit remains substantially the same.

Type 6J6 twin triodes are used for both horizontal and vertical bar generators, each being connected in a simple multi-vibrator circuit. The circuits are similar, except that the component values have been selected to give the two different frequencies required. Fine frequency control is by means of a variable pot. in one grid circuit in each case.

One half of a 12AT7 is used as an RF oscillator, covering approximately 50 to 100 Mc on the fundamental, and 100 to 200 Mc on the second harmonic. The other half of the 12AT7 is used as a modulator valve and to which the bar signals are applied. Also, by overbias-

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421	33uh video r.f. choke	3/4
422	39uh video r.f. choke	3/4
423	56uh video r.f. choke	3/4
424	68uh " " "	3/4
425	82uh " " "	3/4
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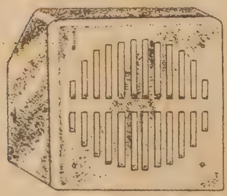

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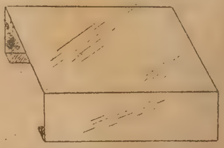

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standard plates, nickle on black. 1¼in x ¼in in the following titles:—

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Note—OFF-ON is available both in a vertical and horizontal type.

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Nickle on black graduated 0-100 thru 180 degrees. 2in dia. .. 1/9

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As above but 1¾in x 1¾in .. 1/9
Graduated 0-10 thru 330 degrees. 1¾in x 1¾in, to match above scale .. 1/9

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sing it considerably it is made to function as a rating valve and produce white dots in the last switch position.

As we mentioned before, this facility is not likely to be needed in Australia for a long time, but we have retained it in the interests of completeness.

The remaining valves are a 6X4 rectifier and OA2 voltage reguator in conventional roles.

The function switch gave us some food for thought, the original being very much a "special" produced for this particular unit. Since there was nothing like it readily available on the local market we had to make do with a standard type. We finally selected a three-deck 2X5, and wired it to perform the same functions as the special. One of the 1X5 sections is not required but is a normal part of the standard switch.

Another problem was a suitable tuning capacitor. We encountered this previously when working on the marker section of the Sweep and Marker Generator and had to improvise with a standard B/C type. This time we managed to persuade a local manufacturer to produce the size we wanted and which, incidently, would probably also suit the marker generator.

SPECIAL CAPACITOR

It is a midget two gang type, with each section having approximately 50pf maximum capacitance, and provides just enough coverage for the purpose.

The RF choke in the plate circuit of the RF oscillator is not particularly critical and we wound ours over the 22K resistor in parallel with it. In our case the resistor was one of the old-style 1 watt types and if the exact value required is not available something much higher may be used (say .22M or higher), and the 22K added as a seperate unit.

The wire used was 32 SWG enamelled, and the length of the winding ¾in. Alternatively, it may be wound on one of the newer 1 watt resistors, the winding occupying the full length of the moulding. Avoid those resistors which are not insulated from the outer covering.

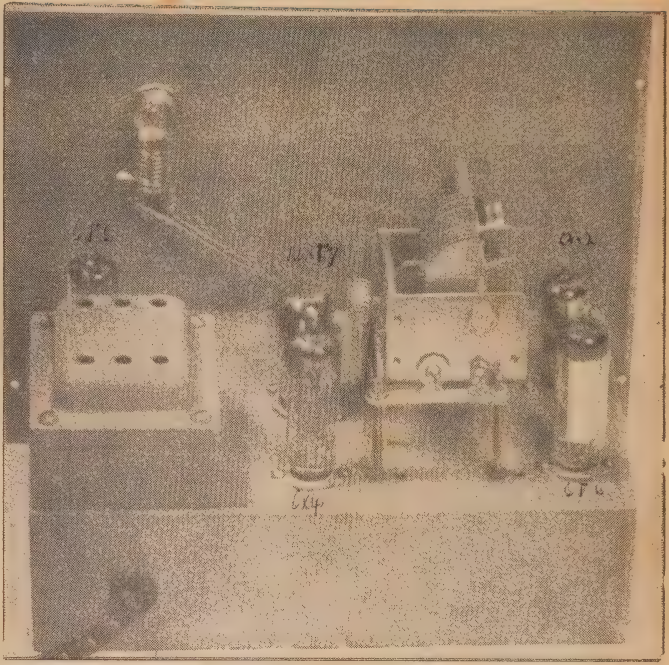
Except where otherwise specified in the circuit, all the resistors are half watt types. The only awkward value is the 3,000 ohm 10W. This rating may not be readily available, leaving a choice between the 5 and 20W types. The latter are perfectly satisfactory, though rather more bulky and expensive. We tried a 5W type and, while obviously running hotter than the makers intended, has stood up to many hours operation so far. If nothing else is available it will at least serve temporarily.

STANDARD CASE

The case is our Standard Small Instrument case, similar to that used for the R/C Bridge, 1in. Oscilloscope, etc and which is readily available from most dealers. The chassis is the same size as for these, but needs to be punched for this application. A chassis blueprint will be available shortly, and will also be forwarded to the various chassis manufacturers.

We are also hoping that at least one manufacturer may make available an etched or anodised label to suit this instrument, and which would considerably improve its appearance and utility.

FURTHER DETAILS OF ASSEMBLY



The valve behind the power transformer is the vertical oscillator, and the one at centre rear of the chassis is the 6X4. Behind it is the 12AT7, with the OA2 at right rear of chassis. Behind it is the horizontal oscillator. Note the method of gang mounting.

The power transformer is a standard 225 volt, 40mA type, with a single 6.3 volt winding. In our case it was one of the horizontal variety, but there is plenty of room for a vertical type as well. This may make the layout a little simpler underneath the chassis.

The wiring does not present any special problems and is not particularly critical. However, a layout similar to our

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1 Standard Small Instrument Case with chassis and panel (either blank or punched).
1 2 gang tuning capacitor. 50-60 pf. max.
1 power transformer. 225V 40 mA 6.3V
1 3 deck. 2X5 switch.

VALVES
2 6J6
1 12AT7
1 0A2
1 6X4

RESISTORS
All ½W unless otherwise specified
1 .25M pot.
2 .22M
1 .15M
1 .1M
1 50K pot.
2 47K
1 33K
1 22K 1W
5 22K
1 15K
1 10K
1 5K pot. (carbon or wire wound)
1 3000 10W
1 1500
1 100 1W
1 47

CAPACITORS
1 24 mfd 300V
2 16 mfd 300V
1 .02 350V paper
1 .01 ceramic
1 .005 ceramic
1 .001 ceramic.
1 100 pf mica or ceramic
2 47 pf mica or ceramic
1 15 pf mica or ceramic
1 7.5 pf mica or ceramic
4 7 pin miniature sockets
1 9 pin miniature socket
1 single contact mic. plug ans socket.
C/1/02M & c/1/01F
1 large finger grip knob
4 small pointer knobs
1 indicator lamp bezel
1 3 tag terminal strip
2 4 tag terminal strips
1 7 tag terminal strip
1 terminal
nuts and bolts, hook-up wire co-axial cable solder lugs, 18g tinned copper wire, 32 SWG enamelled wire.

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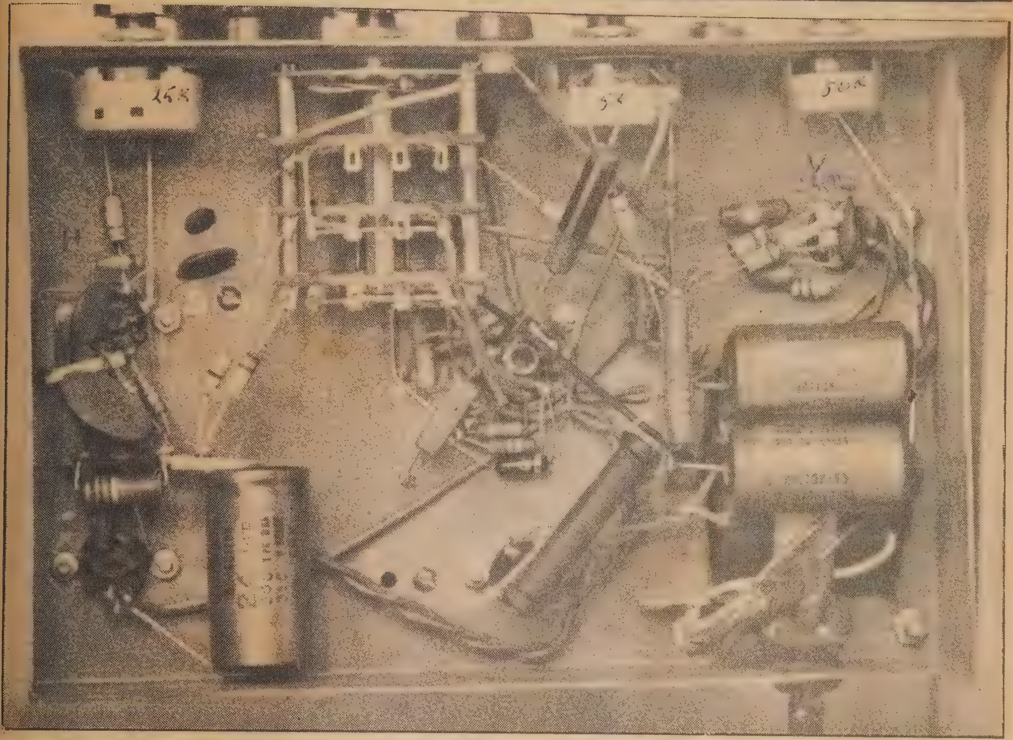

This picture will assist in placing the component and gives a good idea of the wiring. The power transformer is at lower right with the 16 mfd electrolytics in front of it. Above it is the vertical oscillator stage, with the attenuator control to the left. The horizontal control and oscillator stage are on the extreme left.

own allows a logical placement of parts and allows most of the minor components to be mounted by their own pigtails.

Reference to the underchassis photograph will give a good idea of the general layout, and the following additional points should be noted:

The valve sockets should be correctly orientated, and the space between the pins may be taken as reference. In the case of the 12AT7, this faces toward the voltage regulator (OA2) socket. Each of the 6J6 sockets face toward the 12AT7, while the rectifier and regulator sockets are not particularly critical.

POWER LEADS

A three tag terminal strip at the rear of the chassis near the power transformer serves to terminate the incoming power leads and the transformer primary leads. A seven-tag strip near the 12AT7 socket supports the 100 ohm power supply resistor, one end of each 16 mfd capacitor, the .02 mfd by-pass and the 15 pf and .15M from the nearby 6J6 socket.

A four tag strip is also used at the other end of the chassis between the horizontal oscillator and voltage regulator valves. It supports the decoupling components in the plate circuit of this oscillator, one end of each 22K resistor, and one end of the 47K and .22M coupling the .01 mfd to the switch.

The switch can be partly wired before mounting, 18 gauge tinned copper wire being used to bridge the appropriate contacts on each deck and between decks. One of the contacts in the unused section is used as an anchor point for one end of the 15 pf synch coupling capacitor.

In order to locate the tuning control in a reasonably balanced position on the front panel it is necessary to mount the gang about 1¼in above the chassis. Four 1½in x 1/8in Whit. machine screws, with extra nuts are used for this, as shown in the rear photograph.

The gang is coupled to the tuning knob by means of an extension shaft and an insulated coupler. Main purpose of this is to avoid gross leakage from the RF oscillator and, although not as vital as in the case of a normal generator, is a worthwhile precaution. Drive to the gang is direct, there being little point in a reduction drive in such a simple application.

TUNING COIL

The coil is a simple self-supporting winding mounted directly between the two insulated terminals of the gang. It is wound from 18g tinned copper wire on a ¼in former, and is spaced to occupy ¾in. A small amount of pruning may be necessary, particularly if the gang manufacturers market a slightly larger capacitance gang. We have recommended this, as the sample supplied had only just enough coverage.

The coil is best adjusted by means of a grid dip oscillator if one is available but, if not, a standard receiver may be used. Channels 1, 2, and 3 are accommodated on the fundamentals, and from 3 to 10 on the second harmonic.

RF. OUTPUT

Although we have striven to provide complete coverage with the instrument, there is some doubt whether this is strictly necessary, since the behaviour of a set on any one channel (in terms of linearity etc.) will be identical on all other channels. However, it is necessary to be able to select at least one blank channel in any district, so that limited coverage could ultimately be awkward in some situations.

The RF output is taken from the cathode of the RF oscillator section and fed to a single contact microphone socket on the front panel. A matching plug with a convenient length of coaxial cable attached is used to connect the generator to the set.

The indicator lamp is a simple panel mounting bezel, with a lamp holder mounted behind it. You can please

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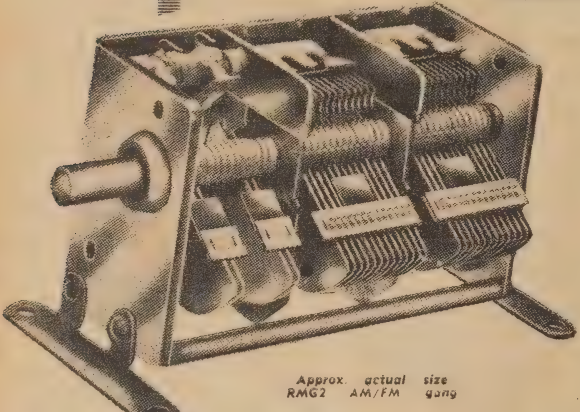

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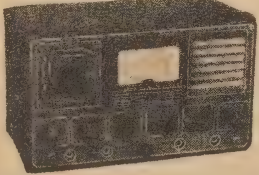

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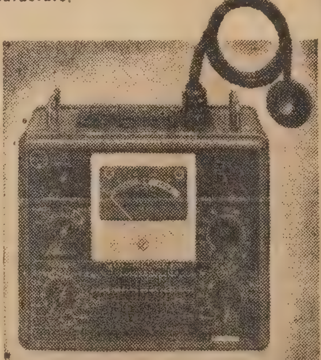

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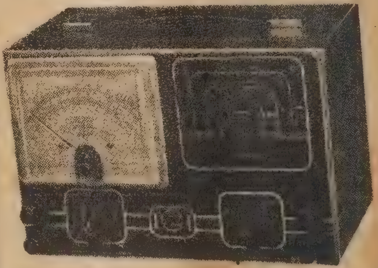

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yourself about the actual mechanical arrangement you use.

In use, the RF output is fed to the aerial terminals of the set and a length of insulated hook-up wire connected to the synch terminal on the front panel. This is simply draped over the deflection yoke or wrapped around the leads running to the yoke.

Some receivers employ low impedence yokes, and the pick-up from these is considerably less than with the high impedance types. If possible wrap the lead several times around the yoke and possibly the yoke cable as well.

The receiver should be set to a blank channel and the generator set to the same channel, the final tuning being done by watching the screen for signs of a pattern. The pattern required is one of bright bars on a black background. It is possible to get a faint reversed image, but this is a spurious response and should be ignored.

ADJUSTMENT

Adjust the generator to give the brightest bars, then vary the generator horizontal and vertical controls to make the picture lock. However, for the most accurate results, it may also be necessary to adjust the receiver controls, and a few points on this theme are worth considering.

In order that the receiver should perform, under test, in the same way as it does on program material, it is desirable that both deflection systems should be operating close to the normal frequencies of 50 cps for frame, and 15,625 for line.

This is particularly so in the case of the frame oscillator, since the inductance of the frame output transformer can affect the height and linearity. Since there may be barely enough inductance anyway, the performance may vary considerably if the frequency is appreciably less than 50 cps.

Since the natural tendency is for the oscillator to run slow when not locked to a station, it may be necessary to adjust the frame oscillator control to bring it back to something like the correct frequency. To do this it may be necessary, initially, to establish the correct frequency by means of a CRO and then to calibrate the horizontal control on the generator, remembering that this setting should give a certain number of lines on the screen. The receiver control could then always be adjusted to fulfil this requirement.

If no such means are available for checking it may be sufficient simply to note how it is necessary to alter the receiver frame control in order to make the oscillator run fast, then set it to run slightly faster than its normal free running frequency. The oscillator is running fast when the picture rolls smoothly, and slow when it jitters without locking positively.

LESS CRITICAL

The line adjustment does not appear to be so critical in this regard, but the same procedure could be adopted if so desired provided the line hold control on the receiver under test is one which is accessible and readily adjustable.

Once a stationary pattern is obtained, you may proceed to adjust the various receiver controls to correct apparent faults. While it may seem like being over-critical, don't hesitate to measure the spacing of the bars with a pair of dividers if you have any doubts about the final result. For one thing, the curvature of the screen can make it quite difficult to judge the spacing accurately in some circumstances.

Before making adjustments involving the vertical bars, make sure that the drive to the line output stage is correctly set, since this can affect the linearity, particularly on the right of the screen. In general, the linearity control is mostly effective around the centre of the screen, while the width control also has some effect on the left of the screen.

The height and vertical linearity controls will also have to be juggled one against the other for the best overall result, and it is in such applications that a stationary, controllable pattern is so valuable.

As well as linearity checks, this instrument will be found helpful in making focus (particularly where magnetic focusing is employed), ion trap, and centring adjustments, all of which are easier with a standard stationary pattern.

Another use is in checking for pincushion or barrel distortion; an effect whereby the lines near the edge of the screen appear to bow inwards or outwards respectively. This is generally due to the yoke design, but can also be caused by incorrect ion trap adjustment.

Altogether, you will find this an extremely useful instrument, and one which no serious experimenter can afford to be without. By taking the guesswork out of adjustments it can save a great deal of time and produce much better results.

STANDARDS FOR AUSTRALIAN TV

Here is something which servicemen, students, and experimenters will find extremely useful; a condensation of the Australian TV standards as they are most likely to be required in the workshop.

OUR standards provide a channel 7 Mcs wide for each station, which is utilised as follows: The vision carrier is 1.25 Mc above the lower limit, to accommodate the vestigial sideband, and the complete set of sidebands extends upwards in frequency.

The sound carrier is located .25 Mc below the upper limit frequency, this being 5.5 Mc above the vision carrier. This automatically locates the inter-carrier sound IF at 5.5 Mc. Video information extending to 5 Mc can be transmitted and received—at least in theory.

For easy reference this information is set out in the accompanying table as it applies to each channel.

When these frequencies are converted to an intermediate frequency by a superhet using a local oscillator higher than the signal frequency (which is normal practice) the position of the sound and vision carriers is transposed. Australian Broadcasting Control Board recommends that these be made 30.5 Mc for sound and 36 Mc for vision. Most manufacturers use approximately these frequencies.

The vision transmitter is amplitude modulated and uses negative modulation. The blanking and pedestal level is set at 75 p.c. modulation, with the sync pulses extending to 100 p.c. modulation.

The black level was originally specified as equal to the blanking level, but has recently been changed. It is now lower than the blanking level by an amount equal to 7.5 p.c. of the range between the blanking and the white level.

When using the intercarrier method of reception it is essential that the vision carrier not fall to zero under any conditions of picture content, otherwise the inter-carrier sound will be momentarily lost, giving rise to inter-carrier buzz. The Standards require that peak white shall be not less than 12.5 p.c. modulation.

The sound transmission is frequency modulated and uses a deviation of 50 Kc either side of the nominal frequency. The audio response may be extended to 15 Kc.

Transmission pre-emphasis is employed and the receiver should be de-emphasised by a time constant of 50 micro-seconds, or approximately 10db down at 10KC.

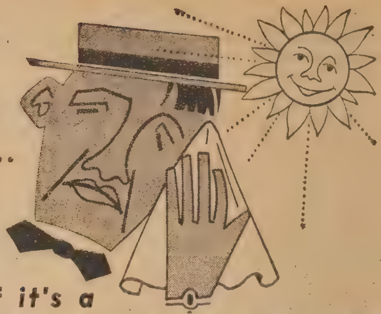
The system transmits 25 complete pictures per second, interlaced two to one, making 50 fields per second. Thus the vertical (or frame) oscillator in the set runs at 50 cps. The horizontal (or line) oscillator runs at 15,625 cps.

Channel Allocations

CHANNEL	LOWER LIMIT	VISION	SOUND	UPPER LIMIT
1	49 Mc	50.25 Mc	55.75 Mc	56 Mc
2	63 Mc	64.25 Mc	69.75 Mc	70 Mc
3	85 Mc	86.25 Mc	91.75 Mc	92 Mc
4	132 Mc	133.25 Mc	138.75 Mc	139 Mc
5	139 Mc	140.25 Mc	145.75 Mc	146 Mc
6	174 Mc	175.25 Mc	180.75 Mc	181 Mc
7	181 Mc	182.25 Mc	187.75 Mc	188 Mc
8	188 Mc	189.25 Mc	194.75 Mc	195 Mc
9	195 Mc	196.25 Mc	201.75 Mc	202 Mc
10	209 Mc	210.25 Mc	215.75 Mc	216 Mc

Channel 3 is for use in inland country areas only. Channels 4 and 5 will not be available until 1st July, 1963. All capital cities are to use channels 2, 7, 9 and 10 except Hobart, which will use 2, 4, 6 and 8.

IT'S NOT THE HEAT, IT'S...



it makes no difference, if it's a

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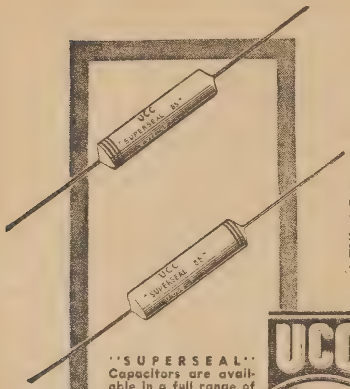

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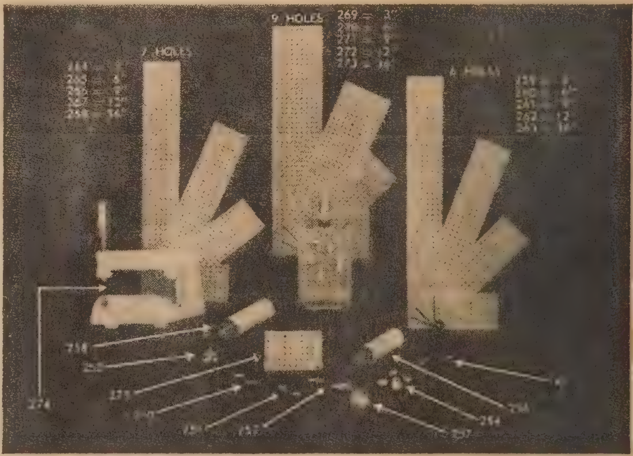

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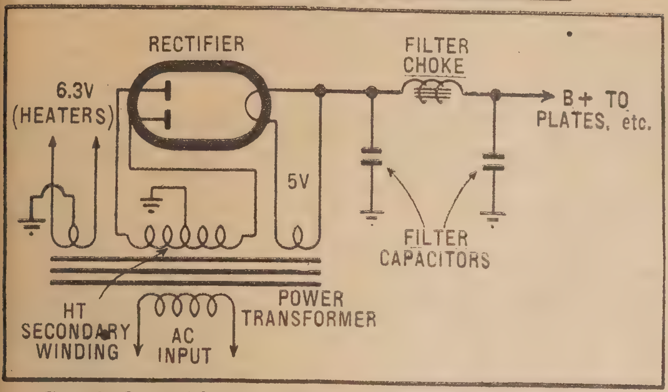

Figure 3: Repeated from our last issue, this diagram shows a basic power supply using a 5-volt rectifier with its own separate filament winding.

How Receivers work from the AC Mains

This month, we continue the discussion of power-supply circuits in mains-operated receivers. The article deals mainly with the problem of filtering to remove hum from the high tension supply, mention also being made of voltage-dropping resistors.

BEFORE actually discussing filter circuits at length, some additional points can well be made in relation to the power transformer and rectifier combination.

In figure 3, last month, we showed a rectifier with its filament circuit operated from a separate 5-volt winding on the transformer. This scheme has been used ever since the inception of domestic all-mains receivers and is still widely used, particularly in larger receivers and amplifiers requiring a substantial HT voltage and current.

However, in recent years, valve manufacturers have produced a number of rectifiers for small receivers which do not require a separate heater winding. Typical of these are the 6X5-GT, 6X4 and 6V4.

INDIRECTLY HEATED

All these rectifiers have a 6.3-volt heater but an indirectly heated cathode, with more than the usual insulation between them. In use, the heater is fed from the same, earthed heater winding as the other valves, the high tension point now being the rectifier cathode.

The revised circuit arrangement is shown in figure 4. It is noteworthy that the rectifier is earthed and the cathode at the full high tension voltage—hence the need for adequate insulation between them within the valve.

There are two advantages in the scheme, both important in small receivers. In the first place, the fact that only one heater winding is needed simplifies the transformer design, making it somewhat smaller and cheaper to produce. Secondly, the heat dissipation from small indirectly heated rectifiers is less than half that from the older 5-volt types, simplifying the ventilation problem in a small cabinet.

One small point in figure 4 warrants special mention, namely the dotted line drawn between the primary winding and the core and shown as earthed.

This dotted line represents a so-called ELECTROSTATIC shield, a thin layer of copper shim wound over the primary but with its ends insulated one from the other, so that it will not form a shorted turn. Its purpose is to limit radiation of RF energy, either noise interference or signal, from the power mains into other wiring and thence into the signal circuits of the receiver.

The desirability of eliminating noise interference from the receiver is obvious.

Signal which enters the receiver by the power mains can be modulated by the 50-cycle supply frequency to produce a hum which is only heard when a station is tuned in. The inclusion of an electrostatic shield in the transformer may or may not eliminate the effect but it is a worthwhile precautionary measure.

As a result, transformers normally include an electrostatic shield and a wire is provided, often a cotton-covered stranded lead, to allow it to be earthed. The shield does not always appear in schematic circuits but one should seek it out as a matter of course and connect the appropriate lead to chassis.

As already explained, the input to the rectifier from the power transformer is an alternating voltage, which may be illustrated as per the diagram in figure 5a.

After passing through the rectifier valve, the alternating voltage emerges as a series of positive-going pulses, shown in figure 5b. This is commonly described as PULSATING DC and, because of its nature, is quite unsuitable for application to the plates and screens of amplifying valves. The effect of feeding such a supply to a receiver or amplifier would be to produce a hum level differing only in degree from what would result with AC on the plates.

FILTER SYSTEM

An essential part of an AC power supply is therefore the filter system, which serves to smooth out these unidirectional pulses to pure DC.

The properties of inductance and capacitance are both commonly put to use in such filter systems.

The inductor consists normally of a large number of turns of wire wound within laminated iron core, much like that used for small power or output transformers. Known as a FILTER CHOKE, it must be capable of carrying the amount of current involved in the particular supply and, with this current flowing, must have an inductance usually of several henries.

In some older-type receivers a filter choke, as such, is not used. Instead, the current from the power supply is passed through a winding around the pole piece of the dynamic speaker. This gives the requisite inductive effect for filtering, and the magnetic field created by the current serves at the same time to energise the speaker's magnet system.

Earlier in the series, we learned that an inductor tends to resist any change in the amount of current flowing through it.

If the current increases above average, part of the energy involved is diverted into creating a stronger magnetic field around the winding. If the current decreases, the magnetic field is reduced and returns some of its energy to the winding as current flow.

LOSES RIPPLE

As a result of this action, current flowing through a filter choke loses a good deal of its ripple content and becomes more nearly pure DC, as shown in figure 5c.

As indicated earlier, capacitance is also involved in a filter system, its effect being more or less complementary that of inductance.

A capacitor tends to oppose any change in the potential or voltage across it.

If the voltage rises above an average value, some of the energy involved is diverted into the capacitor as an extra charge. If the voltage then subsequently falls, the charge is released, tending to maintain the original potential.

When one or more capacitors is connected between the B-plus supply line and earth, as in figure 4, they naturally

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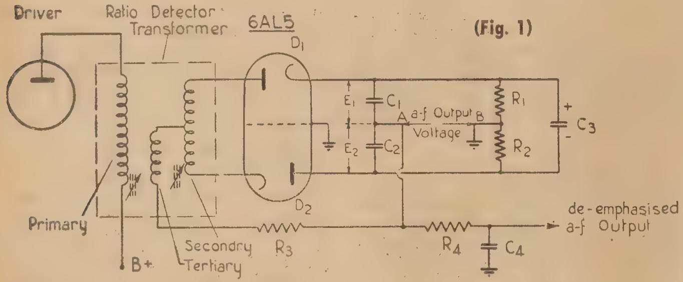
THE RATIO DETECTOR

The requirements of the sound detector in a television receiver are rather varied, and amongst the most important is the need to suppress amplitude variations of the frequency modulated 5.5 Mc/s carrier. In an attempt to gain this a-m rejection without the use of a special limiting stage, the ratio detector was developed. The stage driving the ratio detector is now arranged to amplify for low input levels and to act as a limiter (still with considerable gain) when the input rises beyond a predetermined level.



(Fig. 1)

The voltages applied to the two diode circuits (referring to Fig. 1) are each the vector sum of the tertiary winding voltage and the appropriate half secondary voltage. The normal phase relationships existing in coupled circuits result in a phase difference of 90° between the latter two voltages when the incoming signal is at the centre frequency, i.e., in the condition of zero modulation. This phase difference varies as the instantaneous frequency is affected by the degree of modulation and causes a variation in amplitude of the voltage applied to the diode circuits. One increases and the other decreases as the instantaneous frequency increases and vice versa. Thus the frequency deviation of the incoming signal is converted to an amplitude variation of the voltages applied to the diode circuits.

C3 is a large capacitor which becomes charged in the presence of a carrier and plays a major part in the suppression of amplitude modulation of the input signal. The discharging time constant of C3 through R1 and R2, the diode load resistance, is long compared to the period of the lowest audio frequency to be detected (usually about 0.2 seconds). The voltage across C3 is hence maintained constant over short intervals of time.

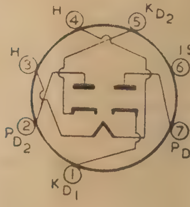
Consider the operation of the circuit at a time when the frequency of the incoming signal differs from the centre frequency by a deviation, Δf, such that the voltage applied to D1 is greater than that applied to the diode D2. The current flowing in C1 must be greater than that flowing in C2. Hence the voltage developed across C1 (E1) is greater than that developed across C2 (E2). The sum E1 + E2 is held constant by C3 and hence point A must be negative relative to point B (earth). So it can be seen that the instantaneous voltage at point A will vary in proportion to the difference between E1 and E2, and hence to the instantaneous value of Δf, and at a rate equal to the rate of change of Δf. Thus the audio output voltage follows the audio modulation of the sound carrier.

R3 is a small resistance which limits the peak diode currents, thus tending to reduce the effects of unbalance in the two halves of the circuit. R4 and C4 form the de-emphasis network which is necessary to correct for the pre-emphasis used at the transmitter to gain an improved signal to noise ratio.

A twin diode ideally suited for use in such a circuit is the Radiotron 6AL5. The performance of a circuit using the 6AL5 is described in Radiotronics, June, 1957. The 6AL5 is also suitable for use as a video detector, a.g.c. clamp and in other applications.

6AL5†

SOCKET CONNECTIONS



bottom view

Pin 1 — Cathode of Diode No. 1.
Pin 2 — Plate of Diode No. 2.
Pin 3 — Heater.
Pin 4 — Heater.
Pin 5 — Cathode of Diode No. 2
Pin 6 — Internal Shield.
Pin 7 — Plate of Diode No. 1.

†For further information on the 6AL5 and other Radiotron Television Valves, consult the TV1 Booklet. Additional copies of this advertisement are available free and post free on request.

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tend to oppose or absorb the change in potential due to ripple from the rectifier. They charge on "peaks" and release energy subsequently to fill the "troughs." Diagramatically, the effect is as illustrated in figure 5d.

Given sufficient filtering effect, the ripple content can be completely eliminated, for all practical purposes, and the output from the supply becomes virtually pure D.C. (See figure 5e.)

Filter systems vary a good deal in actual detail. Over the past years, most receivers have used a filter system basically like that illustrated in figures 3 and 4 — a filter capacitor followed by a filter choke or a field coil, with a second filter capacitor on the output side supplying the plates and screens.

This is known as a Condenser Input or Capacitor Input filter, because the rectifier feeds directly into a capacitor. In the less common arrangement, where the rectifier feeds directly and only in an inductor, the filter is described as a Choke Input filter.

FILTER CAPACITORS

Filter condensers normally need to have a large value of capacitance, certainly not less than eight microfarads each. To obtain this capacitance in small space and with adequate working voltage, not forgetting price either, they are invariably electrolytic types, as described earlier in the series.

The main point to remember about electrolytics is that they must be connected the right way round, with their positive terminal connected to the positive side of the circuit.

In recent years, much higher values of filter capacitance have become practical and, as a result, chokes having much lower inductances will suffice for the same degree of filtering. In point of fact, many small receivers these days do not use a choke at all, relying only on large capacitors to give an adequate storage and filtering effect.

In such receivers, the output from the rectifier feeds directly to a large capacitor, usually about 24 microfarads and then to the plate circuit of the output valve. The ripple may not be entirely eliminated but, because there is no amplification following the output plate, the ripple content is not sufficient to produce an audible hum in the speaker.

DROPPING RESISTOR

The screen of the output valve, together with other stages in the receiver, is normally fed through a resistor of a few hundred to a few thousand ohms, depending on requirements, the further supply point being bypassed with another large capacitor.

The technique of supplying portions of the receiver through resistors, bypassed to earth at the further end, is commonly referred to as Decoupling.

The size and value of the components used in a power supply depend very largely on the amount of voltage and current required by the receiver it needs to supply.

A small set may require something like 150-200 volts at 30-50 milliamps. A medium-sized console or radiogram receiver may require 250-300 volts at 60-80 milliamps. A very large receiver or amplifier may require 300 volts at upwards of 100 milliamps, while a television set may require up to 300 volts at nearly 300 milliamps.

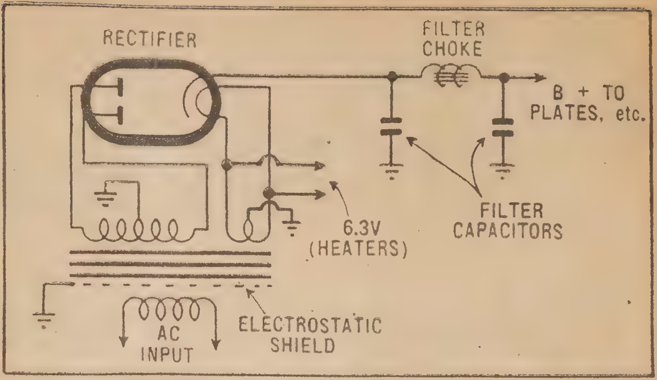


Figure 4: This diagram is similar to figure 3, except that it uses a rectifier having a separate indirectly heated cathode. This eliminates the need for a special rectifier filament winding, being a worthwhile economy measure for small receivers.

We cannot hope to study here in detail the design techniques for power supplies, but a simple explanation of the procedure may cast sufficient light on the subject for present purposes.

The receiver designer first calculates the total voltage and current which will be required to operate the projected receiver. There is more to this than just adding up the nominal figures of current drain for the valves concerned. Depending on operating conditions, the valves may draw varying amounts of current, so that fairly careful study of characteristics is necessary to predict voltage and current accurately.

VOLTAGE DROP

Knowing the current and the likely D.C. resistance of the filter choke, the designer can work out the voltage drop in the filter and add this to the high tension requirements to obtain the voltage necessary from the rectifier.

The rectifier valve must be a type capable of delivering the required current and, by reference to manufacturers' curves, the designer can ascertain the alternating voltage which needs to be applied to the rectifier plates to give the required D.C. output voltage at the expected current drain.

The power transformer H.T. secondary ratings can then be nominated as so many volts either side of the centre tap, at a load current of so many milliamps.

SIZE OF TRANSFORMER

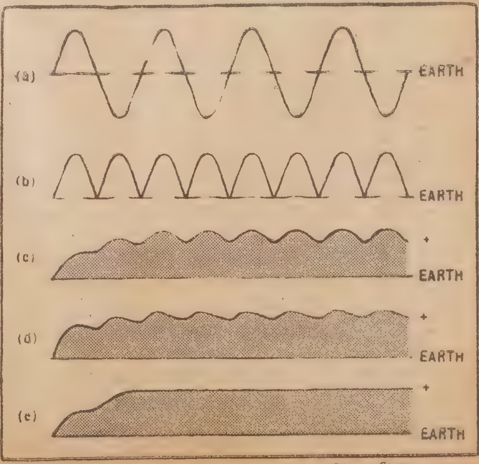
This, in turn, dictates the gauge of wire on the secondary and the likely bulk of the winding. Allowing for this, for the power load it represents and for the filament windings already discussed, the size of the transformer core can be determined. Naturally, the greater the output required in volts and milliamps, the larger must the transformer be.

No reference has been made thus far to obtaining negative volts from an A.C. power supply, to meet the possible need for negative grid bias in the receiver.

In point of fact, the need for a negative grid bias voltage is not so urgent in a mains-operated receiver as in a battery-powered set.

The reason is simply that most, if not all, of the valves have indirectly

Figure 5: This diagram illustrates the way in which AC (a) is converted by a rectifier to pulsating DC (b). By the combined action of a choke (c) and a filter capacitor (d) it can be filtered to substantially pure DC, as shown in (e). Modern tendency is to rely on larger values of capacitance for filtering, reducing or eliminating inductance elements.



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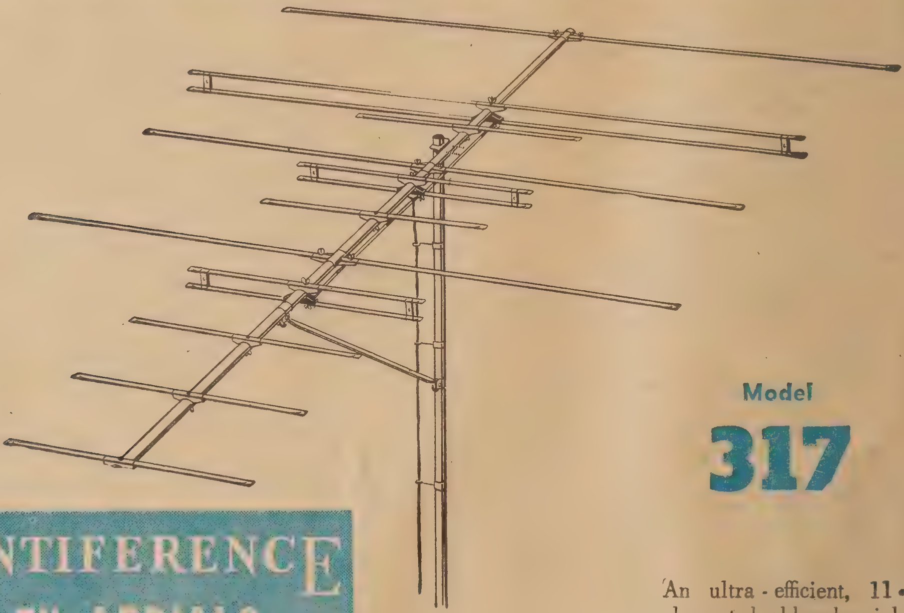

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heated cathodes and bias can be obtained very easily by connecting a resistor between cathode and earth, as shown in figure 6.

Electron current flowing through the valve from cathode to screen and plate has to pass through the cathode resistor Rc. In doing so, it creates a voltage drop across the resistor, the cathode end becoming positive with respect to earth.

If the grid circuit is returned to earth, the cathode must obviously be positive with respect to grid by the voltage developed across the resistor Rc. Alternatively, it can be said that the grid is negative with respect to cathode by the same amount, so that, effectively, the grid has a negative bias.

VOLTAGE DROP

The voltage drop across Rc. can be calculated readily by Ohm's Law, and is simply the product of Rc. in ohms and the total plate and screen current in amps. Alternatively, knowing the plate and screen current and what the bias voltage should be, the optimum valve of cathode resistor can be calculated readily.

Because the plate and screen current vary at signal frequency, the voltage developed across Rc. varies in sympathy tending, as it happens, to cancel partially the effect of the signal on the grid.

This is normally not desirable, and, to prevent it, it is usual to connect a capacitor shown as Cc. across the bias resistor, sufficiently large to prevent a change in cathode voltage at the signal frequencies concerned. In other words, it exercises an energy storage effect.

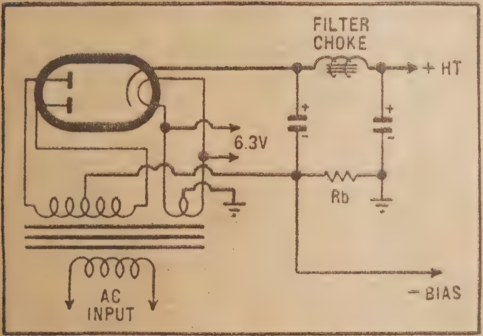


Figure 7: This shows the basic circuit arrangement for a back-bias system. Current flowing through a resistor in the return circuit of the HT secondary winding develops across it a negative potential which can be used as a bias source.

The method, known as CATHODE BIAS or SELF BIAS, is widely used in mains-operated receivers and, if applied to all stages, obviates the need for a source of negative voltage from the power supply.

However, there are occasions where cathode bias is not convenient or where it involves more components than might strictly be necessary. In such cases the circuit arrangements shown in figure 7 can be adopted.

Instead of the transformer H.T. centre-tap being returned directly to earth, as in the circuits previously discussed, it is returned to earth through a resistor. Current flowing from the power supply to the external circuits has to pass through this resistor, and, in so doing, develops a voltage drop across it.

The polarity of the current flow is such that the end of the resistor connecting to centre tap becomes negative with respect to earth. The actual voltage

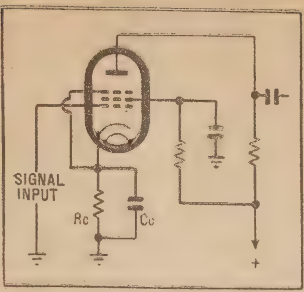


Figure 6: Bias for indirectly heated valves, as used in mains receivers, is commonly obtained from a suitably bypassed resistor in the cathode circuit. If cathode bias is used for all stages, no negative bias potential is required from the power supply.

developed is calculable by Ohm's Law and is dependent on the value of the resistor and the TOTAL current drain from the power supply.

Knowing the bias requirements in a set and the total current drain, it is a simple matter to calculate a value for the resistor Rb. If two or more bias voltages are required, resistors can be connected in series to give the required total value, with appropriate tappings.

The general circuit arrangement is normally referred to as a BACK-BIAS system.

It should be noted that the first electrolytic filter capacitor does not return to earth in a back-bias system, but to the transformer centre-tap. There is a definite reason for this. If it were to return to earth, the charging current from the rectifier into the capacitor would flow through the resistor Rb. and develop across it a very high ripple voltage, which may be injected into a grid circuit, to appear as hum.

Connecting the capacitor as shown puts it right across the output of the transformer-rectifier combination and avoids most of the difficulty.

Where ripple in the bias system must be kept to an absolute minimum, a capacitor may be connected across Rb., or, alternatively, additional filtering or decoupling may be inserted in the lead carrying the bias voltage to the relevant grid circuits.

One other point needs to be made about the final filter capacitor in an A.C. power supply system. It provides valuable filtering, as already explained, but this is not its only role. Have a look at figure 8.

It shows the plate output circuit of the final stage and the lead coming to it from the filter choke. In the presence of grid signal, the plate current of the output valve will vary and develop a voltage across ANY impedance in the plate circuit.

Without the filter capacitor, shown dotted, the valve would develop a voltage across the output transformer and also across the filter choke. In other words, some of the energy intended for the loudspeaker would be wasted quite uselessly in energising the magnetic circuit of the filter choke.

What is no less serious, the signal voltage developed across the filter choke would be superimposed on the B-plus line feeding other valves in the receiver. This could lead to quite serious effects, notably audio oscillation.

With a filter capacitor in circuit having a large enough value, the storage effect is sufficient to prevent the B-plus line from varying its potential at the signal frequency. As a result, all the available energy from the output valve is concentrated into the output transformer and very little of it finds its way to previous stages.

BATTERY-AC SETS?

Such, then, is the story of the A.C. power supply supplies, or, as we titled the article, "How Receivers Work From The A.C. Mains."

In the face of it, the reader may well ask how so many modern battery portables can operate from the mains, still using battery valves throughout. Nor are there any hum problems. Why could not the same be achieved with early battery sets?

The answer to this question lies in the fact that modern battery valves use filaments having a very low battery drain, a typical figure being 50 milliamps.

In the modern portables, the valve filaments are connected in SERIES, instead of in parallel, so that their total

(Continued on Page 75)

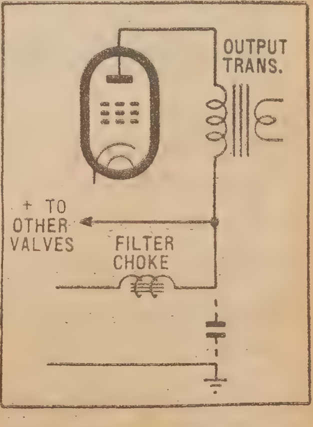
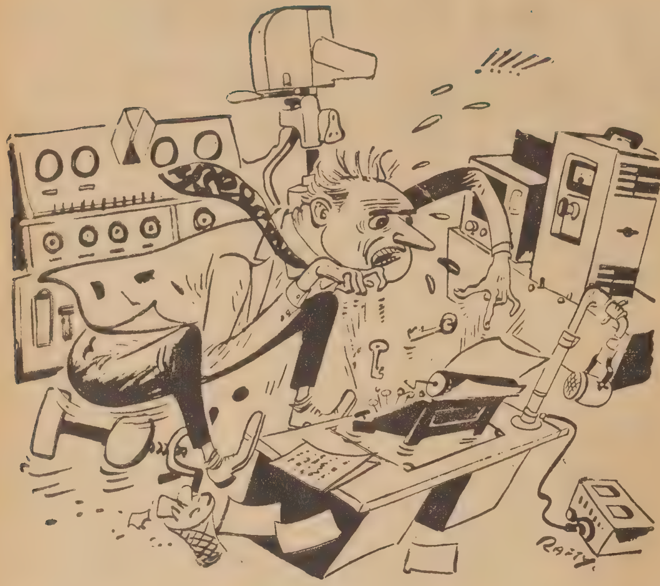


Figure 8: The final filter capacitor in a power supply, shown dotted, serves both to reduce hum level and to provide a return circuit for the audio currents developed by the amplifying valves.



Let's Buy An Argument

Usually, when I profess in these columns to be worried about something, there's an element of fun in the remark. Well, I'm worried again but not in a way that admits of much humour. Quite the reverse, in fact, as you may or may not agree.

by *Neville Williams*

WHAT prompts the remark is an article in a recent issue of "Radio-Electronics," the American publication, which carries an article entitled "Death Rides the Hot Chassis." So as not to waste the impact of the title, the heading and explanatory diagram are reproduced opposite.

The article in question was prompted apparently by the electrocution in the U.S. of a 6-year-old boy, who happened to brush against the metal stand of a portable television receiver; this while reaching into a kitchen drawer for a knife. The metal stand was "alive," the drawer or its environs was earthed and the unfortunate lad received the full mains voltage through his body.

IN ENGLAND

On the very same day, in England, a musician was killed by his own electric guitar, in circumstances unstated.

A few months previously, another young lad in the U.S., just four years of age, was killed while crawling under a TV receiver stand.

Summing up the situation, Fred Shunaman, author of the article and managing editor of "Radio-Electronics," says:

> **"Local papers continually carry stories of people being killed by wire antennas attached to AC-DC receivers, by receivers falling into bathtubs, etc. A compilation of annual deaths caused by household electronic and electric equipment would produce what might truly be called a shocking total."**

In his rather grim discussion of the subject, portable, transformerless and AC-DC radio and TV receivers feature prominently. Why?

Well, in a transformerless or AC-DC receiver, the incoming power mains supply the valve heaters directly, the heaters being connected in series and fed through a suitable dropping resistor. In addition, the mains input is passed through a rectifier and filter system to emerge as DC suitable for the high tension line.

Apart from the unusual amount of wiring attached to the mains, it is inevitable that one side or the other of the mains be directly or immediately connected with the negative side of the high tension supply circuit. This is frequently connected in turn to the chassis and all the metalwork and shielding relevant thereto.

"LIVE" CHASSIS

Since there is no universally accepted method of wiring power points and plugs, there is a fifty-fifty chance that the negative side of the high tension circuit and possibly the metal work of the chassis will find itself connected to the active side of the power wiring in the house.

Since the other side or "neutral" wire is invariably at or near earth potential, a dangerous if not fatal shock awaits anybody who happens to come in contact simultaneously with the "hot" chassis and an earth return path. This is presumably what happened in two of the cases quoted earlier.

Naturally enough, receiver manufacturers don't deliberately set out to produce death traps. They take precautions against accidents happening, but their precautionary measures don't always work out as they should.

The high tension circuit is often isolated from the chassis, returns being made to central busbar. However, to keep this busbar at chassis potential for signal frequencies, a by-pass capacitor usually needs to be connected between them. This capacitor can itself transfer enough AC to the chassis to produce an unpleasant shock or, worse still, it can break down and invalidate the whole scheme.

In the normal way, ordinary wire insulation, stand-off pillars and such like are sufficient to keep the volts where they belong but there is no guarantee that a wire may not be pinched accidentally as happened, I gather, in one recent American fatality.

Dropping or mishandling the cabinet may likewise dislodge insulation or wiring to produce a short.

The aerial comes into it because it is an innocent-looking piece of wire, it comes from inside the cabinet and it must be connected one way or another to the internal circuitry. At best, its safety or otherwise depends on the reliability of an isolating capacitor.

Some American receivers presumably

use a metal cabinet which is intended to surround the live internal "works" and protect the user from shock. The trouble is that the protection is only good so long as the two remain isolated. Careless reassembly after service or mishandling or the innocent substitution of long screws for short ones can create a hazard out of a safety factor.

Wooden or bakelite cabinets would appear to provide an excellent safety factor, when fitted with a rear cover or door. They are—until the cover falls to pieces or a knob is lost, exposing a bare metal control shaft.

ACTUAL CASE

In saying this, I am not just quoting an American article. Only a few weeks ago, a small mantel receiver turned up at my own home on the fantastic basis that I might be tempted to do a good deed for a deserving case!

The set in question had been brought from Europe by its owners and, at first glance, looked like any other mantel set. There had apparently been a back on it, but the back and the means of attaching same had long since been lost. So had one of the knobs. Closer inspection showed it to be a transformerless affair, with a direct chassis-to-mains connection.

As I thought of the several children in the home concerned, there was no difficulty in agreeing with Fred Shunaman's assertion:

"Probably the world's most dangerous piece of electronic equipment is a small hot-chassis type AC/DC radio removed from its case.

"The Americans are at a severe disadvantage, of course, because most of their homes are wired only with 2-pin receptacles and the 3-pin with earth-type of plug and socket, which are accepted as normal here, are largely unknown. There is no simple method of providing an earth protection circuit for their electrical appliances.

Apparently a good many of them are wishing there was. Perhaps some of the fatalities which have occurred may have been avoided as a result.

But what has this to do with the local scene? We don't have transformerless receivers in this country, or not many. Well not yet, anyway!

I can remember having built and worked on a few of them 20 years ago. Maybe some of those original chassis are still in service.

NO ENTHUSIASM

I can assure you, however, t were built and sold without en and tested without relish. The c son for them happening at all w then prevalence of DC mains in the city and certain country areas and the problem which faced some customers of not being certain whether they would have one kind of supply or the other in the foreseeable future.

With the departure of DC mains, just about everybody has forgotten the transformerless technique—until recently.

DEATH
rides the
HOT CHASSIS

This isn't our illustration; it provides the heading for Fred Shunaman's recent article on transformerless and other comparable receivers. Australian designers are facing the issue right now.

Now with television sales people striving to peel the cost of sets to the last shilling, grudging eyes have been cast on the costly transformer. With television portables just around the corner, the weighty mass of iron presents a further problem. The temptation to get rid of it is strong, even though its departure would herald the arrival of the transformerless era, locally.

And what do the authorities think about it, the people charged with maintaining safety practices and the like? Well, I gather that they can hardly gainsay the transformerless scheme, in view of the fact that it has never been really illegal and provided due precautions are taken, whatever these amount to.

After all, from their point of view, the element in an electric toaster, the spiral in a radiator, the windings in a motor are all very much alive at mains potential. Why not then the "works" of a radio or television receiver?

EARTH AVAILABLE

Superficially, this is an admissible line of reasoning and we are "one up" on the Americans by having an earth safety system more or less as universal practice. But should cords fracture or connections come adrift we are "one down" by having a very much more lethal mains voltage.

It is perfectly true that the inclusion of a power transformer does not automatically render a chassis automatically safe. But it does help enormously. With the mains connecting only to the transformer primary winding, the chance of a chassis or its aerial becoming alive is far more remote and the reliance on safety wiring and practices is lessened a great deal.

As far as I can gather, few of the local manufacturers really want to drop the power transformer but competition may force them to, if practice and costs work out that way.

And here's the point. Once having established the practice in television receivers, it will be a small step to follow it in the ubiquitous mantel and mains/battery sets. These are the sets which get carried about, knocked out, plugged into bayonet holders, used with frayed bits of aerial wire—even dropped into bathtubs, it seems.

These are the sets which, like the one I mentioned earlier, lose their knobs and rear covers to expose bare metalwork.

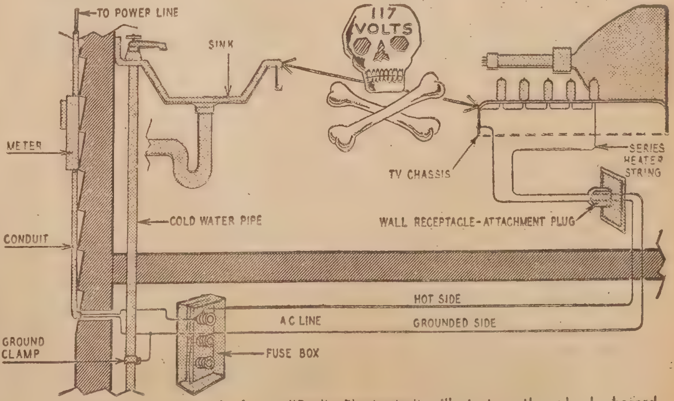
DIFFERENT APPROACH

The argument about live elements and wiring in toasters and motors doesn't hold too well for radio and television sets. By and large, when these appliances go wrong, they are simply dismantled, repaired, tested and reassembled without ever being brought near a power point.

A radio and television set isn't like that. The tester, inspector, repairman, even the set owner who wants to fiddle with an aerial, can only do so with the set switched on and, in many cases, with the chassis bared. These are the times and circumstances when unsuspected faults and careless lapses can kill.

But, after all, who am I to express such opinions, especially if the Standards and Supply Authorities are satisfied?

That's a perfectly legitimate question



This diagram reproduced from "Radio-Electonics", illustrates the shock hazard created by "live" television chassis in an earthed situation.

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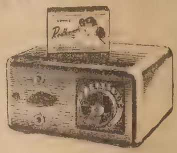

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—or rejoinder. I'm just somebody who's interested in radio, having spent more than half a lifetime at it.

To date, the radio trade in Australia has built up a commendable record of safety for its product. Should the transformerless technique become universal, there is a possibility that this record may be sacrificed.

I could be wrong. I hope I'm wrong—but I am worried.

From a reader in Watson's Bay, N.S.W., comes a letter regarding reasons for restricting severely the amplitude of the sound carrier fed to the detector in a television receiver. I'm not sure that he doesn't immediately contradict himself, but, since other readers might have been puzzled by the same question, let's look at it a little more closely.

"ET TU" GROB!

First and foremost, if our statement is wrong, then a certain amount of discussion is overdue between the McGraw-Hill Book Co. Inc., Donald G. Fink and Bernard Grob, whose joint efforts produced the well recognised text, "Basic Television."

Grob says, and I quote:

> **"In order to produce the sound signal, the first sound IF carrier must have much less amplitude than the picture carrier in the input to the second detector.**
>
> **"This is necessary because, when two signal voltages of slightly different frequencies are mixed, the resultant wave varies in amplitude at the difference frequency and has the original modulation of the weaker of the two input signals.**
>
> **"To preserve the modulation of the sound signal, therefore, the amplitude of the first sound IF carrier is made one-tenth to one twenty-fifth of the IF picture carrier amplitude."**

Out of its context, that might be criticised as a too-general statement, but its meaning for our purpose is quite clear. To make a horrible pun, if it's wrong then somebody has another Fink coming!

Let's see if we can explain the matter in everyday terms:

Assume that we have two signals to be mixed, both modulated, but one having only a fraction the amplitude of the other. We would expect the resultant beat signal to be proportional mainly to the weaker one, increasing as the weaker signal is increased, diminishing to zero as the weaker signal is reduced to zero.

STRONG SIGNAL

Variation in the stronger signal would have some effect, but not very much, unless its amplitude was reduced to something comparable with or less than the former weak signal.

Let's say that the relationship was 100 units of strength for one signal, and 10 for the other.

We would expect to be able to reduce the stronger signal from 100 units to 50 units without much effect on the amplitude of the beat signal because, even so, it would still be five times greater than the 10-unit signal.

But if we kept the 100-unit signal constant and reduced the 10-unit signal to 5 units, then we would expect the beat frequency signal to diminish in strength in almost exact proportion.

DOESN'T LIKE OUR EXPLANATION

Dear Sir:

On page 56 of August issue under the heading "How to build your own IF strip for TV" something appeared that I can't believe, i.e. "that when two signals are mixed in a non-linear device the resultant beat will favour the modulation contained in the weaker of the two." Let us suppose we mix two signals

(1) 2 watts at 70 Mc modulated 100% AM

(2) 1 watt at 75 Mc modulated 100% AM

The power in the two modulations are 1 watt and ½ watt respectively and I am at a loss to see how the powers will be reversed in strength on detection or rectification.

I really think you'll have to put forward another reason why the level of sound carrier is kept low compared with that of the picture carrier. Personally I think the reason is so that it will not be modulated amplitude-wise by mixture with picture information and synch. and frame pulses.

Yours sincerely,
J.F.

DOES LIKE HARTLEY "BOFFLE"

Dear Sir:

I thought that maybe my experiences in building and using the Hartley boffle may be of some interest to you and through you to some reader who has asked for advice. I was particularly interested in the boffle because, in comparison with the vented enclosure, it did away with the necessity for another piece of furniture in the room, and was relatively cheap to build.

My radio cabinet allowed the use of baffle plates 24" x 22"—slightly larger than the R. TV and H. plates and my speaker was the new Philips high fidelity model. I made the apertures as specified in R. TV and H. for June but found on test that the treble response of the speaker was muted to a considerable extent.

At this stage I had the first 3" aperture No. 5 plate because in No. 4 position it fouled the magnet housing of the speaker. To cut a long story short I found that the minimum aperture permissible with this speaker to avoid any muting of the treble bass 3½" and any increase in this aperture meant a loss in bass response.

I also found that bass response was improved the further the 3½" aperture was removed from the speaker. I gather that this gave the effect of a larger enclosure as the speaker cone had a larger volume of air to operate on before it was restricted by the 3½" aperture.

My final disposition of apertures was in this order:- 12", 9", 8", 7", 6", 5", 3½". Results were then mighty fine—in fact I find it hard to imagine that they could be improved. All results have been assessed by ear only but there is no doubt the results are far superior to those obtained on a large open baffle.

Materials cost me £2 and I cannot believe that results obtainable from a good vented enclosure would justify me in the extra trouble and expense in building one, apart from the fact that it would take up considerable space in the room.

Altogether I am extremely well pleased with the results I have obtained and I thank you for having put the scheme in my way.

I am
Yours faithfully,
W.A. (Plympton, S.A.)

P.S. I glued thin fluffy felt on all surfaces of the caneite plates.
Amplifier "R. TV and H." No. 12 (20W)
Control Unit No. 6 (Modified as in "R. TV and H." March, 1956)

Now, if you look back over these last few paragraphs, we are simply saying that the variations in the beat resultant will follow variations in the weaker signal rather than the stronger one, provided it always remains stronger.

And this is precisely what the television standards provide. They particularly stipulate that, even under downward peaks of modulation, the picture carrier shall never go below 10 p.c. of its nominal 100 p.c. value.

In the receiver, it is normal to shape the response curve to keep the sound IF resultant to less than 10 p.c. of the picture resultant so that the picture signal should always be marginally greater than the sound signal.

But over and above this, the strength of the picture carrier, as transmitted, is five times that of the sound carrier, which assures that the strength of the sound IF resultant at the receivers second detector is always well below the picture IF resultant.

There undoubtedly will be some vestige of the picture information left on the 5.5Mc sound intercarrier beat and it is the job of the limiters and ratio detector to get rid of it. This they do, very efficiently, in any well-designed receiver.

And this is where our friend's letter has me puzzled. Having called our explanation into the question, he then appears to advance a reason which means precisely the same thing, expressed another way.

Somebody isn't making themselves very clear.

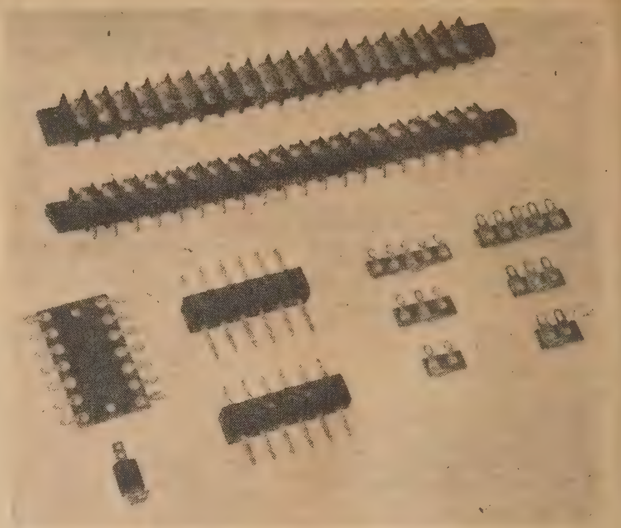
One's natural reaction, of course, is to query treating the sound channel in such a dastardly fashion, reducing its initial strength and then further attenuating it with traps and the skirt of a response curve.

Fortunately it doesn't seem to suffer as a result. There is always plenty of intercarrier beat left to work the sound IF channel and, in extreme cases, I've seen limiter grids producing 50 or more volts of grid-current bias. That's a real signal, even for a limiter.

And, thanks to the limiters and the ratio detector, there's seldom a trace of noise in the background that doesn't belong to the original program source.

This being the case, there's every good reason to keep the sound signal down,

"MEEMADE" TERMINATIONS for Electronic and Electrical Industries



Range includes:

Barrier Terminal Strips. 1 to 20 pair.
Radio Type Tag Strips and Panels—All Combinations.
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Suppliers to Manufacturers and Wholesalers Only.

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Transcription quality manual players

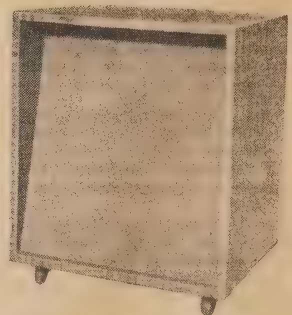
ELAC MIRAPHON

With every feature to satisfy the most critical listener

Special spring mounts, Rubber matted balanced turntable, constant speed motor, no WOW or RUMBLE. In attractive burgundy enamel and white trim.

No. 10, with New Wide Range Crystal Cartridge, response 30-15,000cps **£21/10/-**

No. 11, with Variable Reluctance Turnover Cartridge, response within 2db 20-19,000cps **£42/10/-**



Sherwood A.R.U. Cabinets

Built to Goodman's specifications in Maple and Walnut ¾in ply side lined, with curtains fitted.
Size 23½" x 27½" x 20½".

With A.R.U. fitted **£34/17/6**

Less A.R.U. unit .. **£28/10/-**

NEW PRICE LIST

Send 2 – 3d stamps to cover cost of our new 1957 Descriptive Price List, chock full of Hi-Fi information that will assist your buying now or planning for the future.

LOUDSPEAKERS

Goodmans Trebax Tweeter	£ 11	19	3
Goodmans Midax Unit	£ 26	5	0
3 Speaker System by Wharfdale Wharfdale Super 3in (Treble) Wharfdale Super 8FS (Middle) Wharfdale W15/FS (Bass). Total	£ 70	16	1
Wharfdale 8FS/AL	£ 13	12	4
Wharfdale W15/FS (Bass)	£ 44	3	7
Wharfdale W10/FSB full range	£ 25	5	6
Rola Hi Fi 12UX (Twin Cone	£ 28	19	5
Lorenz Electrostatic Tweeter LSH75	0	18	4
Lorenz Electrostatic Tweeter LSH100	£ 1	7	6

AMPLIFIERS

Armstrong A10 MkII and Control	£ 84	10	0
Leak TL/10 and Tone Control	£ 74	11	0
Stereophon 10w C/W T.C. and wide band tuner	£ 68	5	0

PICK-UPS, TURNTABLES PLAYERS

Leak dynamic P.U. L.P. diamond head	£ 23	18	4
MBH Pick-up 12in L.P. head	£ 14	15	5
Goldring Model L56 Pick-up arm	£ 7	10	0
Ronette 16, 12in Turnover Pick-ups	£ 7	16	11
Collaro Transcription Pick-up 16in	£ 4	19	0
Collaro Transcription 2010 Players	£ 31	2	6
Collaro Transcription Sapphire	£ 1	5	0
Hi Fi Equipment Cabinets 2 door	£ 20	18	0
Cook N-A Beam distortion test record as described in August R. and H	£ 2	17	6
Cook Frequency Test Record	£ 2	3	0

STOP PRESS

A few CONNOISSEUR RANSCRIPTION TURNTABLES still available. Synchronous motor with 3 variable speeds. Hurry.

PRICE £ 49/10/-

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Demonstration Centres:
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average television picture seems to suffer enough aberrations of one kind and another without having an enormous and quite unnecessary sound component interfering with it.

For those whose interest is in sound, rather than picture, we include a letter from a reader in Plympton, S.A. It isn't in any sense an argument, unless someone wants to make something of it. It's just an interesting report, offered in the hope that it may assist somebody else.

A POSTSCRIPT

I regard it as rather bad form to have to add a postscript to a letter, let alone to an article. However, this is a postscript added after the main body of the article had been made up.

In the latest issue of our English contemporary, "Wireless World," are two letters from readers commenting on the subject of "live" radio chassis. Referring to the article previously quoted, one says:—

"I'm completely with him, for I've always regarded the transformerless set run from A.C. mains as an electrical horror. If Mr. Shunaman calls them lethal when the mains supply in his country is 110-117 volts, how much more so are they here with mains voltages ranging from 200-250 volts?

"Probably well over half of the millions of sound and television sets in use here today get their A.C. mains supplies via two-pin plugs and sockets, or even lamp socket adaptors.

"If—and in older houses it's a rather big if—the switch breaks the live lead, the chassis then becomes automatically dead. But if it's the neutral that is broken, the chassis and the often considerable length of flex between it and the socket are live.

"Things are safe enough if only people will follow the maker's instructions and switch off at the set, for that switch breaks both leads."

(This last remark may be rather an unsound assumption as the second pole in many receivers is used to black out the screen, on switching off.)

The second writer has this to say:—

"The double-wound mains transformer has two such big advantages that one wonders why more manufacturers don't use it, in their expensive models at any rate.

"It's core is connected to the chassis, and if this is well and truly earthed there's no chance of the chassis becoming alive.

"Again the mains transformer makes it possible to do away with those horrible chains of valve heaters. If one heater in a series chain burns out, all cease to light up and the serviceman's task of locating the culprit isn't exactly easy. When a valve's cathode is returned to chassis, the potential difference between it and heater may be undesirably large.

"I also wonder whether any manufacturer has toyed with (or even tried out) the idea of building in a constant voltage transformer? In many parts of the country there are considerable drops in the mains voltage at times. They can be large enough to affect the working of television sets seriously, either by giving rise to picture shrinkage or by upsetting the synchronising."

A SIMPLE COURSE IN RADIO

(Continued from Page 69)

supply requirements is something like nine volts at 50 milliamps. Now, 50 milliamps is well within the current rating of an ordinary valve rectifier, and presents no difficulty in terms of filtering ordinary filter chokes and capacitors.

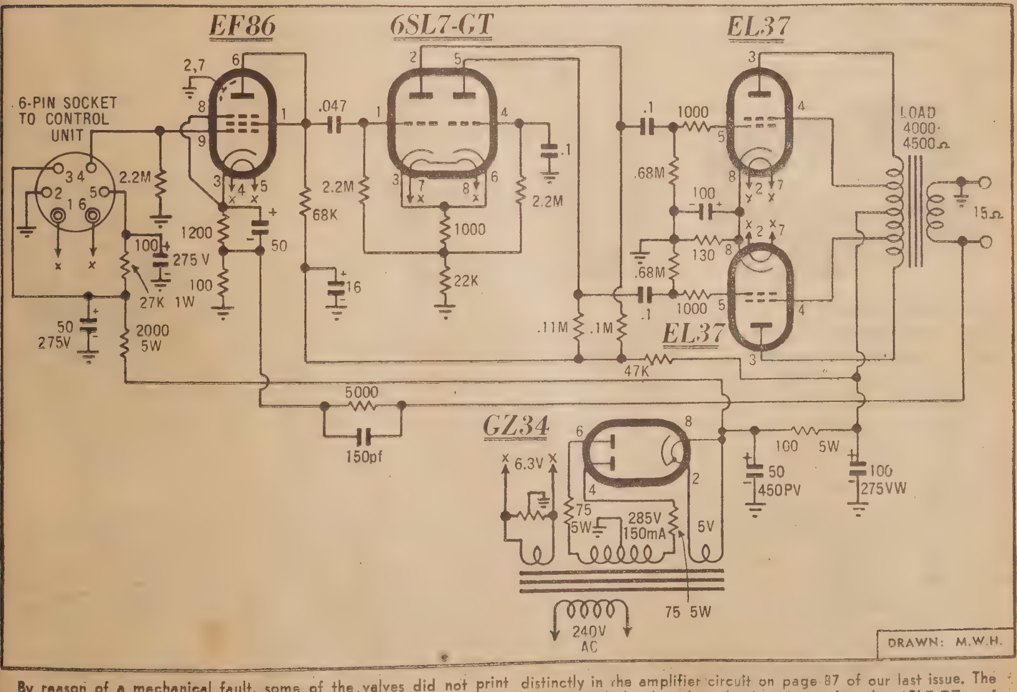
These portables, therefore, include a power supply capable of delivering about 90 volts D.C.—sufficient for the plate supply—at about 65 milliamps, representing the total high tension and filament current. The 90 volts is fed to the B-plus line, while a large dropping resistor reduces it to nine volts for the filament circuit.

Successful application of the method in recent years is, therefore, largely due to the availability of suitable valves coupled with the demand for sets capable of operating from both batteries and power mains.

While undoubtedly convenient, such receivers are nevertheless limited in ultimate performance by the modest design of the battery valves, while reliability is not as good, either, as that of valves having robust cathode structures and intended for prolonged operation from the power mains.

The use of a series filament network also poses some tricky problems of circuit arrangement, since the different potentials between each filament and earth effectively represent an initial bias in relation to the grid circuit. But we are getting into deep waters.

REPRINT OF AMPLIFIER CIRCUIT

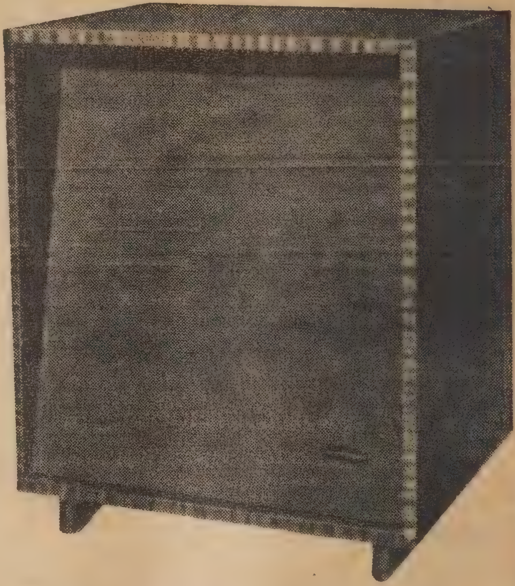


By reason of a mechanical fault, some of the valves did not print distinctly in the amplifier circuit on page 87 of our last issue. The circuit has therefore been reprinted to avoid possible confusion. Note particularly the plate load resistors for the 6SL7-GT and the coupling capacitor to the grid of the lower EL37.

THIS IS THE POINT!

Goodman's Acoustical Resistance Unit

reduces the size of a Bass Reflex Cabinet by one-third through friction loading



Sherwood Cabinet uses ARU size 23″ x 27″ x 20″

the Goodman's ARU will

- **Provide bass response down to 20 c.p.s WITH—**
- **Negligible resonances above this frequency AND—**
- **Effective loading to zero cycles —with greatly reduced distortion due to excessive cone displacement.**

Send for information on Goodman's ARU together with drawings of Sherwood cabinet

LENCO

PRECISION HIGH FIDELITY TRANSCRIPTION MOTORS

Speed continuously variable from above 78 r.p.m. and below 16 r.p.m. Preset adjustable click in positions for 78, 45, 33 and 16 r.p.m. Accurately balanced heavy precision turntable, wow and flutter less than .5 per cent. Large resilient 4 pole motor plays records up to 16 inch. New vertical drive available with or without Goldring Variable reluctance pick-up.

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TRADE REVIEWS AND RELEASES

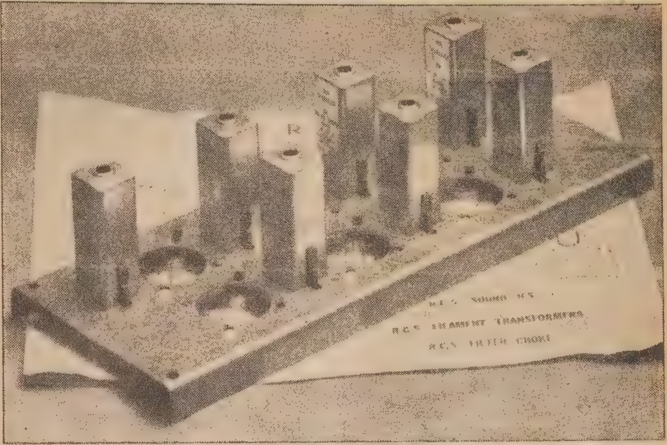
KIT FOR TELEVISION INTERMEDIATE STRIP

A basic kit for our 6AC7 TV IF strip was recently submitted for review by RCS Radio. The kit consists of a ready-punched chassis, the necessary video transformers with built-in traps, the sound IF transformers and the discriminator transformer for the ratio detector.

WE took the opportunity of constructing the unit according to the original R, TV & H circuit data and confirmed that the strip lined up and performed in a satisfactory fashion.

Designated part No. 556, the basic kit is available at £5/10/ plus tax where applicable. It can be supplied wired and tested at £10/10/ plus tax, this amount including the cost of the valves.

R.C.S. will also align completed TV IF strips according to this specification at a cost of £2.



FERGUSON TWIN BALLAST CHOKE

A NEW twin 20 watt fluorescent ballast choke with a novel arrangement to save wiring time and component costs has been introduced by Ferguson Transformers Pty. Ltd. of Ferguson Lane, Chatswood, N.S.W.

The new type, No. CF394-A is similar to the existing CF280-A except for the addition of a winding for preheating one filament of each of the 20-watt lamps. These filaments are connected in series and appear at the centre of the electrical circuit when the lamps are in operation.

The remaining two filaments are operated by a starter circuit in the usual way.

There are a number of advantages for the system the most important of which are the saving of a starter, starter socket, mounting screws and the simplification of the wiring.

The average lamp current is 350mA and the uncorrected power factor 0.52. The addition of the usual 2.7 uF or 3 uF capacitor will give a power factor of the order of 0.9.

Complete technical information including a suggested wiring diagram is available from Ferguson Transformers.

ADVANCE SIGNAL GENERATOR, TYPE 62

The latest piece of equipment to come to us from Advance Components Ltd. is their signal generator Type 62. This instrument is a serious attempt to produce an instrument useful over radio and television frequencies at a low cost. It covers from 150 Kc/s to 220 Mc/s continuously on fundamentals.

INTERNAL amplitude modulation at 400 c/s, to a depth of 30 per cent. can be switched in or out as required. The audio is available separately from a panel terminal at high impedance and approximately a 10-volt level.

A quality attenuator similar to that fitted to some of the more expensive generators is included and the output is continuously variable from 1 uV to 0.1 volt. The manufacturers do not claim an accuracy of better than 2 to 1 on the marked voltage plus or minus 3uV. Output impedance of the cable is 75 ohms.

On the first glance inside the instrument it is hard to believe that so many facilities are provided by so few components. The only valve is a 12AT7 one half of which operates as an RF oscillator and one half as an audio oscillator. The 50 c/s mains are rectified by a metal rectifier.

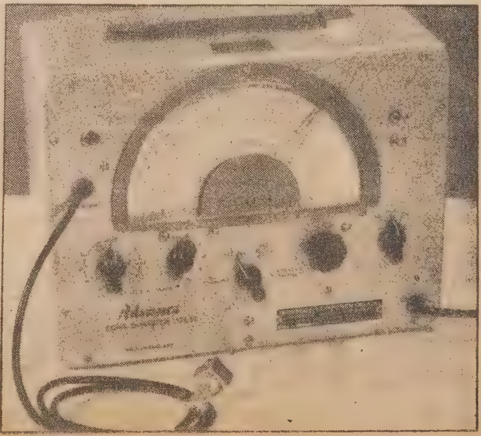
Valve, radio frequency coils and switch are mounted in a spun aluminium container and careful study of the wiring suggests that a great deal of engineering effort has gone into the design of the instrument. Evidence of this is that the instrument covers to 220 Mc on fundamentals.

At £54 the Type 62 must be regarded as good value for the money.

The instrument reviewed was supplied by the Australian distributors, Jacoby, Mitchell and Co. P/L, 477 Kent Street, Sydney.

☆

First impressions of the instrument are that the finish is neat if not lavish. A large semi-circular dial is directly calibrated over the entire range. The high ratio movement makes many turns of the knob necessary to get from one end of the band to the other, but the fine tuning facility will be required at high frequencies.



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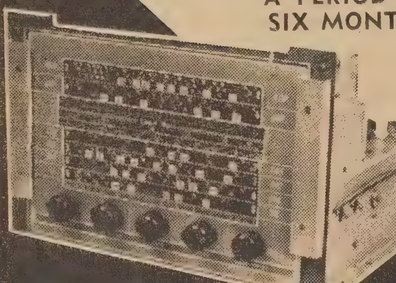

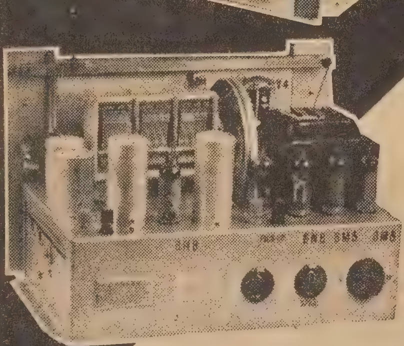

NEW:

Ultramodern circuit using nine high gain valves including "magic eye" tuning indicator. Permatuned iron cored coils and intermediates giving excellent interstate reception and a short wave range of 12,000 miles. All valves used are the new Mullard nine pin innoval series.

NEW:

Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving + or — 15 db. boost or cut at 50 cycles L.F. and 10,000 cycles H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favourite recordings.

NEW:

Dual Speaker combination using a heavy duty woofer (12in M.S.P. Jensen AU54 special) with matching 6in tweeter and cross-over network giving a frequency response of 46 to 13,000 cycles. Speakers are mounted coaxially making only one 11in mounting hole necessary.

If required the new Magnavox high-fidelity twin coned speaker can be supplied.

NEW:

Large calibrated edge-lit dial in plate glass (11in x 7in) with main stations of each State in prominent type. Dial fitted with counterweight drive, giving smooth tuning. Indicator lights are fitted showing which band is in operation. Dial can be supplied in cream, black or brown with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations.

All chassis are wired for the fitting of an F.M. tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and outlet for gramo motor.

Power switch is fitted to volume control, radiogram switch, combined with wave change switch. Audio end of set can be used with TV receiver if required.

A NINE VALVE HIGH-FIDELITY RADIOGRAM CHASSIS

Nine and ten valve chassis incorporate the Mullard 5-10 AMPLIFIER CIRCUIT Frequency response 40-13,000 cycles. Max. output 10 watts.

£41/15/0

F.O.R.

NEW SEVEN-VALVE HI-FI CHASSIS

This new compact dual wave seven-valve chassis uses the same tuner circuit as our 9-valve unit with the Mullard tone-control circuit giving separate bass and treble controls. Push-pull output using two of the new 6BM8 dual purpose output valves and heavy duty M.S.P. speaker. **£31/15/-** F.O.R. PACKING 10/ EXTRA.

Also available with Magnavox 12W.R. Hi-Fi speaker and Ferguson output transformer at £4/15/ extra.

A NEW 10 VALVE DUAL WAVE RADIOGRAM CHASSIS

WITH BASS AND TREBLE BOOST

The ideal chassis for those difficult locations where reception is doubtful. Specifications as nine valve unit, but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short wave bands.

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Write for full specifications

ALL 4 SPEED RECORD CHANGERS AND PLAYERS STOCKED.

Classic Radio

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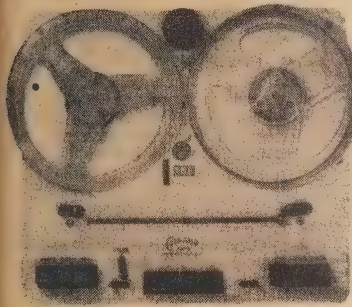
New Collaro High Fidelity Tape Recorder

Complete with Amplifier—Ready to switch on—

The Only Tape Deck with **ALL** these Features

MODEL MK III

All Decks Supplied Complete with seven Valve Amplifier including Level Indicator Power Supply and Speaker.



Only Cabinet Required for Complete Recorder. Can be used in conjunction with Radiogram Chassis for Recordergram.

£69-15-0 F.O.R.

- **HIGH FIDELITY**
Heads are double coil wound and will reproduce up to 12,000 c.p.s. at 7½ inches per second. Azimuth adjustments on both impedence "record" and "play-back" heads. Output of heads is approximately 5 milli-volts at 1 Kc at 7½ inches per second
- **INSTANTLY REVERSIBLE**
Instantaneous changes can be made from one track to the other. Fast re-wind in either direction.
- **CONSTANT TAPE TENSION**
A special Collaro device ensures a constant tension on the tape on the take-up spool as it leaves the capstan.
- **FULLY MECHANICAL**
No solenoids are used in the construction of this Transcriptor. The braking is entirely mechanical.
- **FINISH**
Cream Polystyrene cover plate with maroon controls.
- **THREE SPEEDS**
3¾, 7½ and 15 inches per second.
- **FOUR HEADS**
Two "Record/Play-back" and two "Erase" heads are sited on two different levels and head wear thus halves for any given length of track.
- **TWIN TRACK OPERATION**
One pair of heads for each track. Both top and bottom tracks can be recorded or played back without removing tape.
- **PAUSE CONTROL**
This has the effect of stopping the transit of the tape past the "Record/Play-back" and "Erase" heads and applying the brakes to the spools whilst leaving all switches and mechanical functions in their selected position. Typical application is to pause whilst recording to omit speech interposed between musical selections. Control will only work whilst it is held in position.
- **TAPE MEASURING & CALIBRATING DEVICE**
The three digit counter makes the location of any recorded passage the simplest of operations
- **TRANSCRIPTION TECHNIQUE**
A large diameter flywheel with ground and lapped steel shaft running on a ball at the bottom of long bearing reduces friction and virtually eliminates "wow" and flutter to less than 0.15 of 1.0 per cent.
- **TWO MOTORS**
Each dynamically balanced motor does only one job at a time. Motors never act against each other and are of low wattage input with consequent reduction in heat and wear.

Also available as complete portable recorder—in attractive—and durable plastic covered cabinet with microphone 80 gns. F.O.R.

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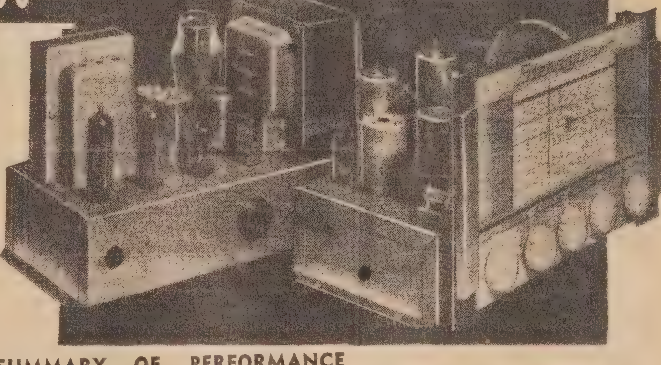
A compact 11-Valve High-grade Radiogram in two chassis featuring a variable band with Tuner multi-input preamplifier and Tone Control in one unit and a 10-Watt Ultra-linear Amplifier. Ideally suited for use with High-grade Pick-ups and Speakers.



SUMMARY OF PERFORMANCE

TUNER: Broadcast Band, 4 position Bandwidth, whistle filter EM80 Tuning Indicator, attractive Dial.

PRE-AMPLIFIER: Microphone input sensitivity 1.5mV
Pick-up input 1 High sensitivity 5mV
2, Low sensitivity 50mV
Tape or TV input sensitivity 100mV
All inputs controlled by one 6-position functional switch.
Power switch on Volume Control.

TONE CONTROL: Separate Bass and Treble Controls giving 20db boost to 18db cut for both controls.
R.I.A.A. Equalisation for L.P. and E.M.I. Equalisation for 78 records.

AMPLIFIER: 10 Watt Ultra-linear with Ferguson O.P. 301 Output transformer 6BO5 output valves.
Frequency response 30-20-000 cycles + or — 0.5db.
Harmonic distortion better than 0.1 per cent.
Output impedance 15 ohms or as required.

QUALITY never before at this PRICE

65 GNS.

Classic Radio

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Record Player Amplifier

very compact and light weight. This unit combines a 4½ watt amplifier with two inputs, one for the built-in 3-speed Philips record player and one for a crystal microphone. Each input has its own volume control. Also two outputs, one connected to the built-in speaker and one for a separate extension speaker. Also an on-off switch and tone control is provided. The cabinet is finished in two-toned leatherette. Ideal for parties or for playing records in the home.

Well worth 35 gns.

Price only 27 gns.

6-inch extension speaker in leatherette covered box worth £3/4/-. **Our price 49/6.** Crystal microphone to match this unit. **45/-.**

3 speed record player in leatherette covered case, automatic stop, turnover head, 2 sapphire needles, plays standard and microgroove recordings. Colours: Fawn and Brown. Worth 18 gns.

Our Price, £13/19/6

SPRING GRAMOTORS, wind-up type suitable for replacement in portable gramophones, etc. Complete with turntable and fittings.

Price only £1/15/

3-speed Record Player Units consisting of motor with turnover head, crystal pick-up, 2 sapphire needles, ideal for both standard and microgroove recordings, automatic stop. English make.

Price only £9/19/6 each.

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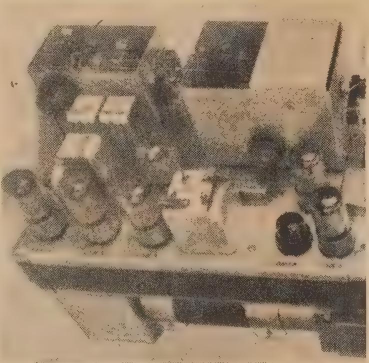

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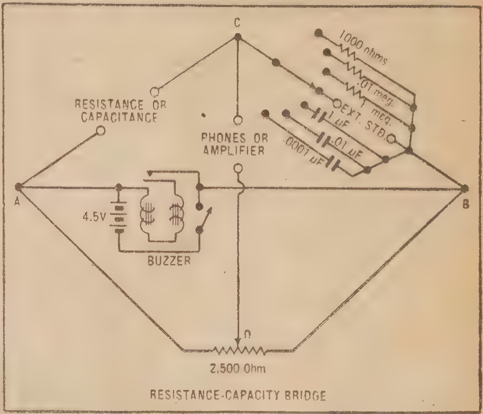
A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

RESISTANCE-CAPACITY BRIDGE ENERGISED BY BUZZER

Bridge circuits are widely used in radio and electrical work for measuring purposes. Accuracy of reading depends on a standard and a calibrated ratio arm in the main but a source of energy and a detector are also required. Our correspondent suggests using a buzzer for the former and a pair of headphones for the latter.



Complete circuit of bridge. The shaft of the 2,500 ohm potentiometer is attached to the pointer. The element should be linear. Volume in phones may be greater with lead from "B" connected to buzzer coil.

RESISTANCE CAPACITY bridges we have described use 50 c/s from the power mains as a source of energy, together with a valve amplifier and detector. The amplifier allows the null point to be made sharper under certain conditions, but many resistors and capacitors can be checked accurately with a much simplified instrument.

Our correspondent, Mr. T. Tongs, of Burnie, Tasmania, has constructed a simple bridge and is very pleased with the results. He explains the principle of operation and comments on the construction in his letter.

"The action of the instrument is fairly easy to follow. If an alternating potential is applied across points A and B of the circuit the current follows two paths—one through point C and the other via point D. The unknown and the standard (in the arm A.C.D.) have a ratio relationship to one another; also in the arm A.D.B. it is possible to obtain a similar ratio between the two portions of the element of the variable resistance.

"When the ratios in the two arms match, potential at C. is the same as that at D. in such a case no current will flow in the phones. By multiplying the value of the standard component in circuit by readings from a suitably calibrated dial on the variable resistance, accurate values for unknown resistors or capacitors can be obtained.

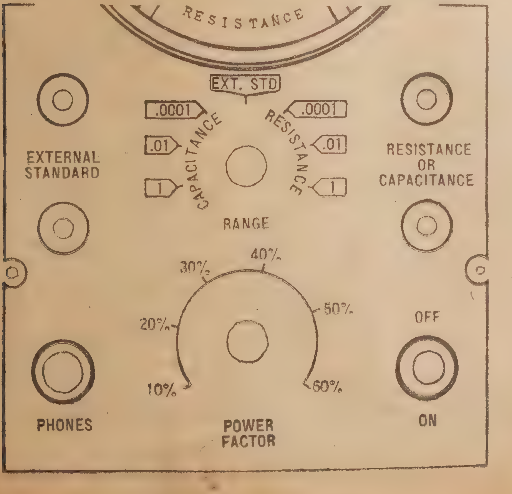
"Calibration of such an instrument is fully covered in R. TV and H, December, 1948, and January, 1955. The writer used components exactly as described in December, 1954, and found the full-sized dial printed therein to be sufficiently accurate for normal radio work.

"Construction of the instrument is straight forward; the buzzer being one of the small high-note types necessitating the points adjustment screw being extended outside the instrument cabinet, to allow easy adjustment. The impedance of the phones is not critical, and most disposal types should prove satisfactory.

Easier nulling can be obtained on the higher value resistors if the output is fed to a good amplifier, gain being increased as the note diminishes towards balance point.

"The whole instrument was housed in a 9in x 5in x 2in case. Fibreboard was used for the front panel, which greatly facilitates mounting of components and lessens stray capacitances between terminals, etc. An identification plate, appearing as indicated in accompanying layout, was carefully drawn up and lettered on tracing paper and an ordinary contract print taken therefrom, producing white markings, etc., on a black background.

"The dial was traced from that shown in R. TV and H. also on tracing paper, but for this a dye-line print was obtained producing black markings on a white background. (Double contact photographic printing will produce the same effect.) Plate and dial were glued together and the whole covered with celluloid and secured to panel by screws, terminals, etc."



The dial scale (bottom just visible) is the same as for one of our standard resistance-capacity bridges. Copies printed on art paper are available through the 2/- query service.

Neat layout of controls used in Mr. Tongs' instrument. Bottom half of front panel is shown here and its full width is 5¼ inches.

A view of the completed instrument, housed in its metal cabinet with an attractively enamelled sloping front panel. The general appearance compares favourably with commercial instruments of this type. You can build it from new parts as a training project or take advantage of the new case and panel to restyle a battered veteran.

Build Yourself An AC-DC Multimeter

Have you been thinking of rebuilding that old multimeter? Or perhaps you require a second one for bench use, one that is always on hand. Well, here are constructional details of a perfectly standard instrument, using readily available components, which will enable you to carry out your service work with a minimum of outlay.

by Wes Yashin

WITHOUT dispute, a multimeter is an indispensable item for both the hobbyist and the professional serviceman. Notwithstanding the number of multimeters we have described in the past, there is a never-ending demand for circuit reprints of this basic piece of test equipment.

Continuously exhausted stocks of circuit reprints and of original issues alike has prompted us to feature yet another constructional project on this instrument. It could very well be the basis for a new multimeter or serve as a guide for those wishing to bring an old one up to date.

PHYSICAL DIFFERENCES

Basically, most multimeters are quite standard nowadays, variations being mainly in the size, shape and layout, as well as the method in selecting the ranges. Our present effort is much the same, in this respect, as several we have described in the past, the differences being mainly physical.

We have selected what must undoubtedly be the most popular shape for an instrument which must spend most of its life on the bench. However, the sloping panel construction does not limit this instrument to bench use only, for the addition of a carrying handle will make it readily portable.

Obviously a meter for continuous use in the field would be safer when built into a standard carrying case and readers will no doubt suit themselves in this regard.

The usual sensitivity of meter movements used in this type of instrument is in the vicinity of 1mA, this figure being a good compromise. It gives a nominal sensitivity of 1,000 ohms per volt.

More sensitive meters are available and multimeters may be designed around them but, the benefits of lighter circuit loading are offset by the increased cost and delicacy of the movement which may be much more easily damaged through accidental overload.

A further disadvantage is that readings obtained with high sensitivity meters differ from those taken by a standard 0-1 meter in certain cases, due to the altered loading. Since readings given in most constructional articles and on commercial diagrams are taken with a standard meter, the position may become quite confusing unless one is capable of interpreting the differences.

DESIGN CONSIDERATIONS

The design of a multimeter involves careful consideration of the ranges that will be required. Experience in this case is the best indication and we have found that for normal work it is desirable to measure direct current within a range of from about .1mA to 250mA, AC and DC voltages from about 1 volt to 1,000 volts and to have resistance ranges up to 1 megohm.

It would be useful to be able to measure still higher values of resistance but considerable difficulty would be involved.

The AC scales are valuable for more than just the measurement of 50-cycle voltages. They also form the basis for the "output" ranges used for receiver alignment.

To suit this present circuit, the meter movement should have separate AC and DC scales and an ohms scale to suit a 1.5-volt battery, with multiples of 15 ohms at about centre scale.

Certain meter movement may have a sensitivity of .9mA. This is to allow for the fact the meter rectifiers tend to read the average value of a sine wave which is approximately .9 of the R.M.S. value. In this case the full sensitivity of the meter is used on the AC ranges while a shunt is added in parallel so that the same set of scales may be ued for the DC ranges.

Should you have such a movement on hand, it will be necessary to obtain from the meter manufacturer, a shunt to reduce the sensitivity to the required amount as well as a new scale with the shorter AC ranges. Likewise, a new scale will be required for meters having an ohms scale calibrated for a battery voltage other than 1.5 volts or for an ohm's circuit other than the one used.

Although this is intended to be a constructional article, a discussion of some of the principles involved in the choice of components may not be out of place.

A meter movement is a current operated device requiring a certain current through it to give full-scale deflection. If we wish to read 10 mA with a 1 mA meter movement, then we will have to connect a resistor in shunt (i.e., in parallel) with the meter coil. The current flowing in the parellel network will then divide and the value of the shunt resistor is chosen, so that 1 mA only flows through the meter, while the remaining 9 mA flows through the shunt.

The same reasoning applies for the other current ranges.

From the foregoing it is obvious that the shunt resistance is related to the meter coil resistance and it is necessary to know the latter, in order to calculate the correct value of shunt. For this reason it is desirable to obtain shunts from the meter manufacturer to suit his particular model of meter, or, at least, shunts that are designed to work with a meter of the same resistance as the one you have on hand.

SELECTING MULTIPLIERS

The voltage ranges in a multimeter are obtained by placing resistors in series with the meter movement, the values being such that 1 mA only will pass through the meter coil when the complete instrument is connected across the full-scale deflection voltage that is required. The calculations involved are quite simple, requiring an application of Ohm's Law.

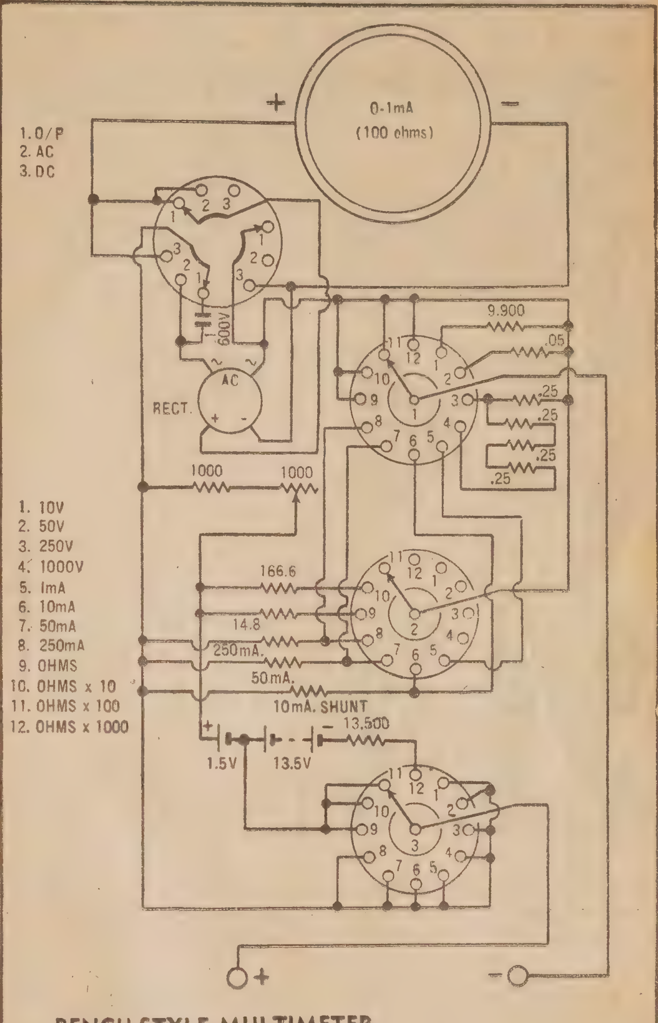
For example, if a range selected is to indicate a full-scale deflection of 1000 volts, one can calculate the series resistance required to pass 1 mA through the meter. Including the meter coil resistance, the series resistance works out to be 1 megohm. Since the meter resistance is only a small percentage of the total, it is generally ignored, and a series resistor of 1 megohm is specified.

Only for the 10-volt range is the meter resistance a significant proportion of the whole, and the multiplier resistor should ideally be 9,900 ohms, not 10,000 ohms.

The same set of multiplier resistors is used for the A.C. ranges, provision being made to switch in a small rectifier unit after the multiplier resistors.

Meter rectifiers are generally of the copper oxide or selenium type, and are extremely small and light in weight. Barring abuse, they will last indefinitely. Their only disadvantage is that of being non-linear on very low voltage ranges, but this is not serious for normal radio work, providing the meter has a suitably calibrated scale for low A.C. volts.

THE COMPLETE CIRCUIT DIAGRAM



BENCH-STYLE MULTIMETER

DRAWN: M.W.H.

The circuit is perfectly standard, one that we have used on prevous occasions. Since a three-deck 12-position switch is used only two terminals are required. The switch sections are numbered commencing from the top.

A copper oxide rectifier works by virtue of the natural qualities possessed by copper oxide when in contact with pure copper, namely, that of allowing electrons to flow more readily from the metal to the oxide than in the opposite direction. A similar one-way movement of electrons is evident in a selenium type.

A meter rectifier is made up of several of these discs pressed together and connected in a bridge circuit to enable full-wave rectification to be achieved. Since little curret flows through the rectifier, cooling problems do not arise, and the whole assembly is often moulded in bakelite, with leads or lugs brought out for connection into the circuit.

As mentioned earlier, the slight inefficiency of the rectifier becomes evident on the 10-volt A.C. range and, to compensate for it, the 10-volt A.C. range is made a few per cent shorter than the other A.C. scales.

Another point which may be noticed about the 10-volt scale is that it is non-linear. This means that the distance over the first several divisions is not the same as that over the last. The difference is due to the rectification efficiency, which varies with the voltage present in the circuit.

Next we have the output meter section, which, with the aid of a blocking capacitor, allows alternating voltages to be measured, while ignoring D.C. potentials. The capacitor is in series, with the multiplier and permits only A.C. signal currents to pass through to the rectifier and meter movement.

The output ranges are intended primarily to indicate changes in relative output from a receiver undergoing alignment with a signal generator modulated by 400 cycles per second or thereabouts.

No attempt is normally made to indicate power output in watts or to maintain accuracy at very low audio frequencies, where the increasing reactance of the blocking capacitor progressively re-

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PRIMARY—200, 220, 240V 50 cps

H.T. SEC—295-0-295V 275 m.a.

L.T. SEC.—6.3V, tapped at 5V-3A
6.3V-9A

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INDUCTANGE—1 Henry

D.C. CURRENT—275 m.a.

D.C. RESISTANCE—26 ohms

FEATURING—Full rated inductance at maximum current — Low resistance — Window clamps for electrical and mechanical stability—Effective internal lead anchoring, common to all FERGUSON components—Fully impregnated.

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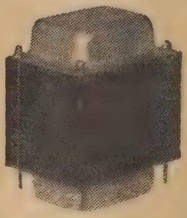
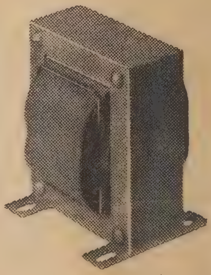
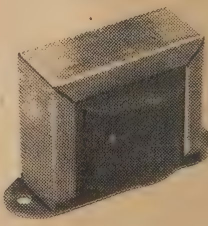
PF1193



CF388



PF1290-PF1294



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duces the reading, particularly on the lower voltage ranges.

Finally, we come to the resistance ranges. These involve a number of resistors, a "zero adjust" potentiometer and several small batteries to energise the circuit.

The resistors and the batteries are arranged and adjusted so that 1 mA flows through the meter when the test prods are shorted, indicating zero resistance. If a resistor is interposed between the prods, a lesser amount of current will flow and the meter will give an appropriate lower reading. To avoid making a calculation each time, the resistance scale is calibrated directly in ohms.

Small rearrangements to the circuit enable us to multiply the scale by 10, 100 and 1,000 as required. It is often desirable to multiply the scale by 10,000 or higher but, unfortunately, extra batteries would be required and this would not be practical in a portable instrument

CABINET DETAILS

Some years ago we published constructional details for a wooden bench-style meter case and a constructional drawing is reproduced for the sake of those who may want to duplicate it. However, at least one chassis manufacturer is planning to make available a metal cabinet with an anodised panel for those who require a professional finish and that is what we chose for our own use.

Meter movements are generally calibrated for two types of panel, ferrous and non-ferrous, the former being appropriate for bakelite or aluminium, as used in the present meter.

The internal layout of components is much the same as that of several multimeters we have described in the past. All the resistors and the .1 mfd blocking capacitor are mounted on a length of resistor mounting strip, which is in turn, mounted on the meter terminals and held by the terminal nuts. The coded photograph which we have prepared, should assist you in this regard.

Resistance strips with silver plated contacts, if available, are ideal to use, as they are very much easier to solder. Switch contacts are normally plated and will not be a problem. The use of paste flux in wiring a multimeter is not recommended, as an excess of flux will cause leakage around contacts.

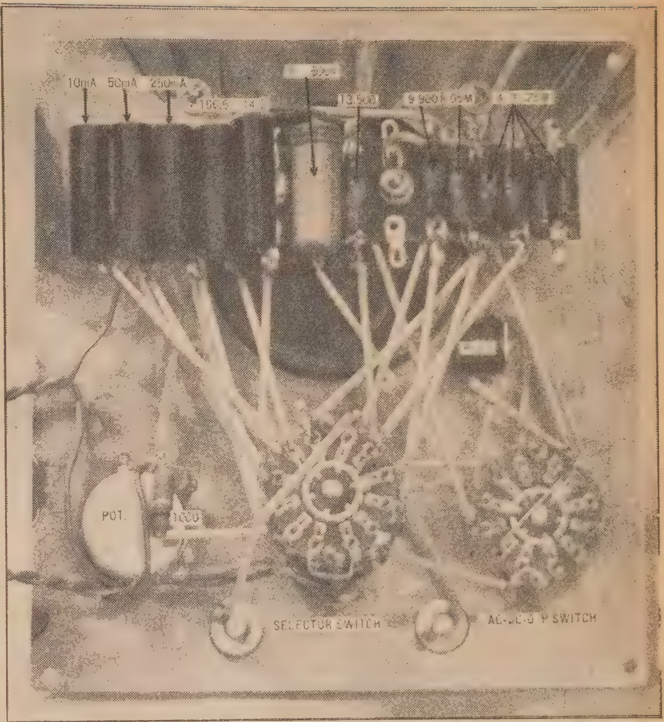
SWITCH WIRING

Ordinary hookup wire of 18 gauge spaghetti-covered tinned copper wire is quite suitable for wiring runs between the switch contacts and the terminal strip. Do not forget to include solder lugs under the meter terminal nuts.

Some readers may not be familiar with the construction of a 12 position switch and a word about this may not be out of place. A close inspection will reveal a moving arm and wiper, as well as a position contact on the underside of the wafer. This contact is for the 12th position, there being room for only 11 positions and the moving arm on the upper side of the wafer.

Moving in a clockwise direction from the moving arm contact, the positions are used in the normal manner. After the 11th position, the moving arm contact is reached and the top section of the wafer ceases to function. However. as the switch is clicked into this position, the moving arm on the underside of the wafer connects with the 12th contact, which is placed directly below the first contact.

A REAR VIEW OF THE METER



A rear view of the panel showing the component layout and the wiring. The coding should help you identify individual components. The mounting strip attaches directly to the meter terminals, while the rectifier is fixed to a bracket which is held by one of the meter mounting screws.

PARTS LIST

1 case and panel.
1 0-1 ma meter with scales as specified.
1 1 or 5 ma. meter rectifier.
1 length of resistor strip.
1 3-bank, 12-position oak switch.
1 single bank, 3-pole, 3-position oak switch.
1 1000 ohm potentiometer.
1 .1 mfd 600 volt paper capacitor.
1 1.5 volt torch battery.
3 4.5 volt torch batteries.

SHUNTS

1 10 ma, 1 50 ma, 1 250 ma, 1 166.6 ohm, 1 14.8 ohm.

RESISTORS

1 per cent high stability types.
1 9900 ohms, 1 .05 meg, 4 .25 meg. 1 13500 ohms.
Standard tolerance types.
1 1000 ohm.

SUNDRIES

Test leads, terminals or tip jack sockets, mounting screws, solder lugs, tinned copper wire and spaghetti or hookup wire, scrap metal for brackets, rubber feet and carrying handle for case

No undue precautions are required when wiring the switch. The method of using the contact is same as that for any standard switch. Contacts 1 and 12 are insulated one from the other while the two moving arm contacts are permanently interconnected.

A little extra care in locating the mounting holes will result in a neater-looking instrument. Lock washers under the switch and potentiometer mounting nuts will prevent these items from coming loose with constant use.

RECTIFIER DETAILS

The meter rectifier may be mounted on a small bracket which, in turn, may be attached to the panel by one of the meter mounting screws. Do not cut the rectifier terminal leads too short as excessive heat, while soldering, may damage the rectifier. If your rectifier is equipped with terminal lugs, the use of a hot, well tinned, iron will shorten the soldering operation and safeguard the rectifier.

The rectifier will normally be colour-coded, the AC input terminals having some common colour while the DC output terminals will normally be red and black to denote positive and negative respectively.

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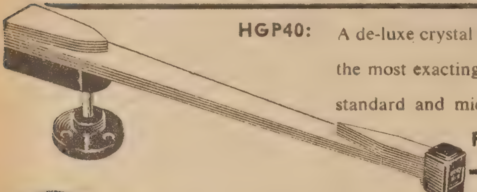
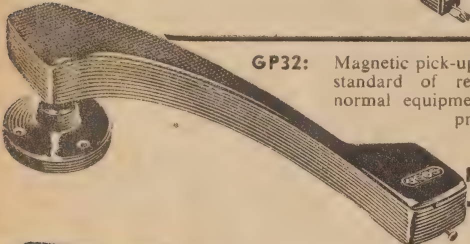
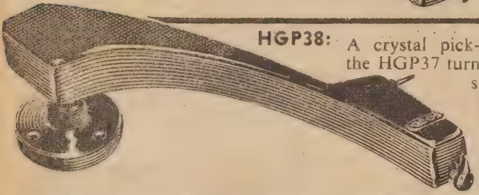


HGP40: A de-luxe crystal pick-up to satisfy the most exacting. Complete with standard and microgroove heads.
PRICE, £9/15/-



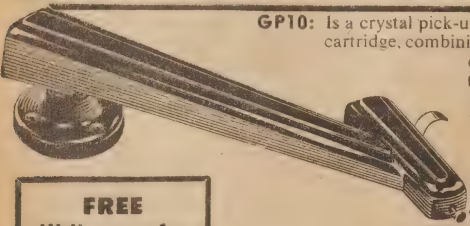
GP32: Magnetic pick-up provides a good standard of reproduction with normal equipment at reasonable price. Output voltage, ½ volt at 1,000 c.p.s.
PRICE, £2/12/6



HGP38: A crystal pick-up. Incorporates the HGP37 turnover cartridge for standard or microgroove recordings with cantilever stylus.
PRICE, £5/15/-

GP50: Is a HIGH-OUTPUT crystal pick-up suitable for reproducing standard and microgroove records through *low-gain* amplifiers as used in small record players and some radios **PRICE, £4/19/6**

GP60: Incorporates the latest-type CERAMIC cartridge—unaffected by heat or humidity. For use in tropical areas **PRICE, £6/16/-**



GP10: Is a crystal pick-up utilising the GP9 cartridge, combining purity of reproduction with extreme reliability. Resonance-free response from 50/8,000 c.p.s. Output, 1.5V at 1,000 c.p.s.
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plus these acos replacement cartridges

HGP39 CARTRIDGE

Designed to meet the most exacting requirements of modern recordings — low element mass and very high compliance enables the heaviest modulation possible to be traced with a minimum of record wear. Both standard and L.P heads available **PRICE, £3/12/6**

GP9 CARTRIDGE

Now famous as the cartridge with the unbreakable crystal. Takes standard steel or fibre needles for 78 r.p.m records **PRICE, £1/11/6**

GP59 CARTRIDGE

A HIGH OUTPUT cartridge suitable for reproducing standard and microgroove records through low-gain amplifiers **PRICE, £2/3/-.**

CARTRIDGE GP61

A CERAMIC cartridge that will withstand the rigours of a tropical climate and is, at the same time, very robust **PRICE, £3/19/6**

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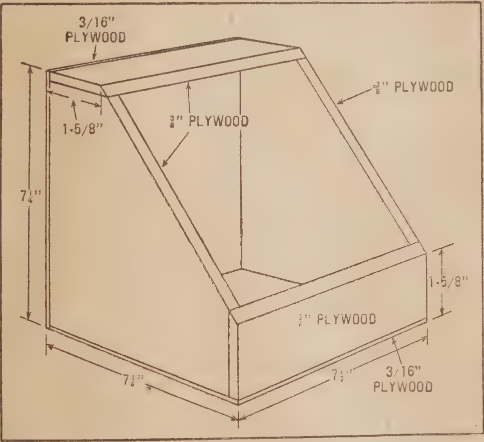
The multiplier resistors should ideally be of the cracked carbon high stability type, having a tolerance of 1 per cent. These may not be extremely easy to obtain but are well worth waiting for if you desire long term stability from your instrument.

The remarks made about soldering the rectifier terminals apply equally well for resistors since excessive heat may effect a permanent change in the resistance values. A good method to use in wiring these, is to hold the pigtail with a pair of long-nosed pliers, close to the resistor body, while the soldering iron is being applied.

Special mention must be made about the method of wiring the shunt resistors. The circuit is drawn in such a way as to suggest this desirable method. Two switch decks are used to minimise the effect of switch contact resistance.

An inside view of case showing the placement of the batteries. Scrap metal brackets were bent up to keep the batteries secure. Do not forget a set of rubber feet.



Right: A constructional diagram of an alternative wooden cabinet for those wishing to make their own. Joints are made with glue and panel pins and the dimensions given are outside dimentions.

RESISTANCE

Since most shunts are very low in value, any series resistance will have an appreciable effect on the total resistance and therefore the reading accuracy. The most obvious way of switching these shunts unfortunately introduces series resistance which is present at the switch contacts.

Since the value of contact resistance is likely to vary with the age and condition of the switch, this resistance cannot be allowed for in the manufacture of the shunts.

Using the method suggested for switching the shunts, however, allows us to bypass the contact resistance as far as the shunting effect on the meter is concerned. The contact resistance then simply adds to the resistance introduced into the external circuit by the meter.

In this way, the readings are not likely to be affected, since the contact resistance will normally be much less than that of the external circuit.

If normal hookup wire or 18 gauge tinned copper wire is used for connecting the switched ends of the shunts to the switch contacts, a very negligible amount of series resistance will be introduced as well. This resistance may be decreased by running two sets of leads from the switch contacts to the ends of the shunts rather than bridging the contacts and running a single lead.

It now remains to install the batteries within the case, wire them in, and the instrument should be ready for a test. A suitable scrap metal bracket may be bent up and anchored to the bottom of the case to hold the batteries. The leads from the batteries should be long enough to allow access to the rear of the panel without having to disconnect them.

We fitted a pair of Philips type terminals, to obtain extra flexibility in the use of the instrument, but ordinary tip jack socket should do.

A suitably engraved panel will add to the appearance of your multimeter and, may be available in two forms, engraved laminated bakelite and anodised aluminium. Those not wishing to go to the expense of such a panel may obtain, through our query service, a copy of the panel on art paper, which can be glued to a plain panel or held under a piece of perspex.

You will undoubtedly wish to check your new multimeter against one known to be accurate. However, before doing so it would be wise to roughly check the operation of the various ranges. A mains-operated receiver should provide you with the necessary test voltages.

When making these checks be ready to disconnect the meter immediately should the needle go hard over due to an error in the wiring or a fault in one of the components. If all's well, you will have one of the most useful and versatile instruments on your test bench and any extra care you have put towards constructing and finishing it will be well repaid.

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OFF THE RECORD — NEWS & REVIEWS

Is Jazz just a noise or a serious form of musical expression? How would Beethoven's Fifth Symphony have sounded if some of the original sketches had been adhered to? What are the essential ingredients of the Blues?

By JOHN MOYLE

IF you would like to hear the answers to these and other musical questions, you should listen to Leonard Bernstein's lecture demonstrations on a pair of Coronet records recently released.

One, is "What is Jazz?" occupies two full sides, on which Bernstein begins with a talk about the foundations of jazz, the birth of the blues, the jazz treatment of the popular song, and continues right down to the emergence of modern jazz improvisation, which, he claims, could become the American musical form of the future, and is already verging on serious concert music.

WHAT IS JAZZ?—Leonard Bernstein looks at jazz with the assistance of several of its leading exponents, including Buck Clayton, Miles Davis, Louis Armstrong, Bessie Smith, Teo Macero and Buster Bailey. Coronet KLP5.

This lecture is accompanied all through with musical illustrations of the various points as they are made, particularly during the analysis of the Blues, as neat and well ordered an exposition of a musical subject as I have ever heard.

Whether what he has to say is news to you or not, you will be intensely interested in it, even if only to agree with or to question his argument and subject matter.

SERIOUS ATTITUDE

For the man is perfectly serious in what he has to say—this isn't just a routine program annotation made vocal, or an innocuous press-agent stunt to sell a record.

I'm sure you will react to it in some way, just as I did.

Nearly everybody has some fixed opinion about jazz, even if they don't know what it is about. Like modern painting, the less they understand it, the more violent they are likely to be.

But if you were to strike up an analytical conversation on the basis of such reactions, how often will you unearth a reasoned position?

This is a matter which has given me a good deal of thought for many years. ever since I became vaguely aware of the artistry displayed by some of the early masters of the art, and witnessed the mistaken enthusiasm of the young of later years who fell for shameful exploitations by those who did not have the spirit of jazz in them.

Unfortunately, so many people class anything played with jazz instruments, and subject to syncopation with or without voices as jazz, and have condemned it on the musical evidence supplied by those who have long deserted its principles.

Bernstein feels many of these things, for, although he sets out with the avowed intention of explaining jazz and not defending it, he very soon manoeuvres himself into the position of doing both.

SPECIOUS ARGUMENT

His explanations I found very good, his defence arguments impressed me less.

For instance, he says many people dislike jazz because they think it is low class. He continues that most music is low class because its origins were humble and often rest in folk music.

That type of argument is superficial and specious.

The truth is that most people dislike jazz because it, or something like it, is the universal language of low places, and is often exploited for such, not because it is necessarily low in itself. Let us be clear about what is form and what is matter. Many jazz utterances are without doubt very low, so don't let us be mealy mouthed.

But it isn't right to say that folk music is necessarily low because it is humble. Much is earthy, but you rarely find deliberate exploitation of vulgarity and worse in folk songs.

He explains that the essence of jazz is the building of variations on a theme by virtuosi, and instances some piano variations of Mozart as being another example of the same thing.

Anyone with a smattering of musical feeling will realise from Bernstein's own examples that there are variations and variations. He says that jazz instrumentalists "play about" with the tune, "have fun with it."

Mozart would be deeply insulted if we thought his carefully studied and artlessly perfected variations had much in common with what often turns out to be a string of conventional jazz "licks" played against an often witless tune, with little more meaning than an unending babble.

He says again that the metre of a blue lyric is written in iamabic pentameter, the same form as used by Shakespeare in his plays, and even sets some Shakesperean lines to a blues tune.

WHAT CONNECTION?

Now, now, Mr. Bernstein, where is the connection? After all, a blues lyric had to have some metre, and it may be true that both poet and jazz pioneers happened on the same form because of its convenience and natural rhythmic flow.

It would have been just as easy to have made the point using much less exalted examples of a very common metrical device.

One feels that had the number of lines been 14, instead of another very common A.A.B. progression, we would have had a new stature added to the sonnet form.

There is form to the jazz idiom, and Bernstein deals with it logically and well. But to suggest it has much real common ground with what we broadly call the classics doesn't serve any useful purpose. Every device used by modern jazz was in fact invented and exploited by the masters of music centuries ago, and any form of music, good or bad, must use some or all of them.

The real difference is that, whereas the classics used form and notation to say something sufficiently worth while to endure for hundreds of years, who will remember more than a fraction of jazz material longer than a few months?

SOMETHING TO SAY

You will find that the jazz which endures has something, no matter how slight, to say to us. Maybe that's why Mozart's variations are still fresh, while those of the fashionable clarinettist soon pall, after their ingenuity is forgotten.

There's nothing wrong with good jazz, there's nothing about its simple formula that a musical student doesn't know in advance. The trouble is firstly that most people don't bother to understand the difference, and secondly that so much jazz and pseudo-jazz has such an appallingly dull and elementary mental standard that I for one find it has nothing to say.

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Having got all that off my chest, I still recommend this record most heartily; it is a masterpiece in its way, and should be studied and understood by anyone who is serious about the subject, and I count myself of their number.

Significantly, you will find Bernstein's final examples of advanced jazz as bordering on serious music have none of the objections I have raised, and all of the requirements I look for in good jazz, even if you find them somewhat obscure.

* * *

LEONARD BERNSTEIN ON BEETHOVEN.—Symphony No. 5 in C minor, Opus 67. Played by the Philharmonic Symphony Orchestra of New York, conducted by Bruno Walter. Coronet KLC568.

In case you should imagine that Bernstein is interested only in jazz, listen to his lecture-demonstration of Beethoven's Fifth Symphony.

This is the most perfect and the greatest symphonic work ever written. You can examine it through a microscope for its perfection of form, balance of musical shapes, almost mathematical progression of interest curve, or you can just listen and marvel at the magnitude of what it has to say.

Neville Cardus is fond of relating that after his n'th concert hearing of this symphony, he headed his review: "Beethoven's Fifth Symphony—Still in C Minor."

In so doing, I think he unconsciously paid it the highest of tributes.

Bernstein doesn't embark on what could easily have been unnecessary rapture about aspects which are not generally in dispute.

MANY COMBINATIONS

Instead, he sets out to show how painstakingly Beethoven pored over his manuscript, trying out sometimes 20 different methods of handling a passage or instrumental combination, until finally he chose the one we now feel is so inevitably right.

Bernstein has examined manuscript evidence and extracted some of the discarded sketches from the composer's work.

He then has the orchestra play these passages to show how they would have sounded if Beethoven had not replaced them by those we hear today.

The result is fascinating and illuminating. No other evidence could have been so spectacular in showing the genius which Beethoven brought to his work

It is a remarkable side.

On the turnover there is a performance of the complete symphony, conducted by Bruno Walter.

Unfortunately, I can't praise this as highly.

In order to compress the symphony into the single side, groove spacing is cut to a minimum, and there are faint but frequent groove echoes as a result. The cutting amplitude is much lower than on the other side, and surface noise is therefore more apparent.

Walter persists in his habit of introducing sudden tempo changes which are quite disconcerting, and I just can't take the second movement played at such a slow pace.

The performance, too, is sometimes ragged and untidy, as though the orchestra was being held unhappily in check

Despite all this, I rate the record most highly, and it represents a new and extremely valuable method of getting down to an understanding of what music is all about.

The splendid jacket contains reproductions of Beethoven's manuscript referred to in the argument.

* * *

SAINT-SAENS—Concerto No. 1 in A minor for Cello and Orchestra. ERNST BLOCH—"Schelomo," Hebraic Rhapsody for Cello and Orchestra. Played by Leonard Rose and the Philharmonic Symphony Orchestra of New York conducted by Dimitri Mitropoulos. Coronet KLC 572.

Leonard Rose, erstwhile leader of the cello section of the orchestra which now accompanies him, has two valuable attributes which are essential to a first-class cellist—he has a firm and extremely beautiful tone, and faultless intonation.

Whether he has the vitality and breadth which distinguishes the three or four great cellists of the day is not altogether proven by either of these performances.

The Saint-Saens is one of the standard concertos, but it does not make very great emotional demands.

The Bloch is a free, rhapsodical work in which the cello is the spokesman for the Jewish spirit, but nowhere is Rose called upon to display the full power of the cellist's art.

The Saint-Saens is the best recorded version there is, and probably the best performed.

Its superiority over the recent Capitol release is instanced in the slow movement, played more slowly it is true, but with much better sound and sensitivity.

If you like the music, you can safely buy.

* * *

BEETHOVEN—Quartet No. 14 in C Sharp Minor Opus 131. Played by the Budapest Quartet. Coronet KLC 599.

After waiting so long for recordings of works such as this, two issues have hit us in quick succession.

At least no one will now feel that his likes and dislikes have been overlooked, for these two versions represent with high competence two different view points.

The Hungarians, who recently played the quartet for Columbia, are bright, clean-cut, almost impatient players.

The Budapest Quartet has a more classical manner, more introspective, less eager to get on all cost and analytical almost to a fault.

For my part, I would select this record as the better performance, mainly because it frees me from the complaint that I have many times levelled at the Hungarians—their unwillingness or inability to moderate their speeds.

I do not mean that the Budapest play unduly slowly. As a matter of fact they each take the Presto movement at the same pace.

The impression of speed is not merely a matter of so many crotchets per minute.

I don't think there is any doubt that the Budapest selection of tempos is responsible for the feeling that they are coping more successfully with the music.

Moreover I feel they have deliberately set out to meet its challenge in every particular.

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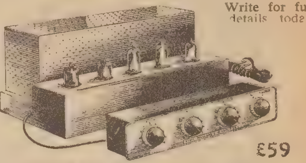

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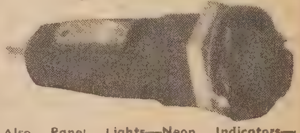

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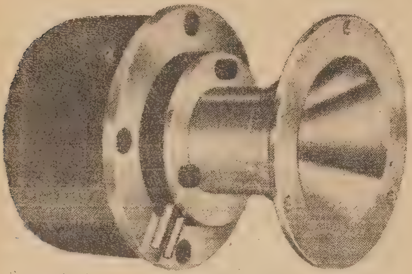

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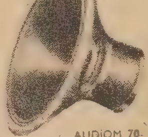

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I suspect that the Hungarians are often inclined to rush by, content to leave many musical ideas behind them.

This record was made using a set of Stradivari instruments in the Washington Library of Congress, to which they were given on the understanding that they were never to leave the premises. The recording was made in the auditorium at the library.

As a result, the instruments have an average age of about 250 years.

This does not necessarily mean that they sound best when played together, but the recorded tone is much fuller and rounder than that of the Hungarians, and most people will like it better.

If you are serious about music, sooner or later you will get around to these later Beethoven quartets. When this happens, you will find it hard to pass up this record, despite the high standard set by the Hungarians.

The surface is very quiet, and technically excellent.

* * *

JOHN STRAUSS Jun.—Le Beau Danube. One-act Ballet by Massine, music arranged by Roger Desormiere. Played by the Orchestra of the Paris Opera conducted by Manuel Rosenthal. Capitol P-18006.

My first reaction was of surprise that Johann Strauss Jun. had written so much music ideal for ballet, but there it is, and irresistably pleasant to hear.

For the purpose of the ballet it has been pushed about and adapted, but the process does violence to nothing.

It is probably the steadiness of the beat which most clearly defines its link with ballet, but there is no concealing the fact that the music was made for dancing.

The orchestra plays with the utmost zest and gaiety.

Recording is bright, a little weighted in both top and bottom, but in keeping with the general atmosphere.

A record all will like. Surface is excellent

* * *

HANDEL—Five Arias from Giulo Cesare. MOZART — Arias from Don Giovanni, Cosi fan tutte and Le Nozze di Figaro. Sung by Lisa Della Casa with the Vienna Philharmonic Orchestra conducted by Heinrich Hollreiser, Josef Krips, Karl Bohm and Erich Kleiber. Decca LXT 5277.

The beauty of the Mozart arias alone would justify this fine disc.

I haven't heard this singer before but there is no doubt she has many of the rare essentials of a fine dramatic soprano, or more correctly, a mezzo-soprano.

It could be that the more familiar items affected my judgment, but I thought she was more suited to Mozart than to Handel.

Apart from a clear voice, of great vitality, truth and range, she has the ability to follow the most difficult passage with certainty and ease.

On one occasion she is called upon to take a leap of a twelfth, and it's no mean feat to manage it as smoothly and unostentatiously.

Her Dovo Sono would do credit to any Mozart soprano of the day.

On both sides the Vienna orchestra plays magnificently. Together with the singer, they are aided by first-rate recording, clear and round and vital.

The Mozart side is rather cleaner than the Handel, and some of the numbers are up to demonstration standard.

In these remarks I seem to be rather hard on the Handel, but that's not my intention.

Both sides are extremely fine and it's quite a highlight in its class.

* * *

TCHAIKOWSKY — Symphony No. 3 in D Major, Opus 29. Played by the London Philharmonic Orchestra conducted by Sir Adrian Boult. DECCA LXT 5297.

This symphony, as with most of Tchaikowsky's earlier efforts, illustrates how much he drew on them in material and manner for his later and better works.

Almost before this one begins we hear echoes of the Pathetique. In the fourth movement there is a clear look forward to the piano concerto, and in too many places to mention you will find yourself harking back to a phrase and a progression that could have been written by no one else.

I could not help comparing the prolixities and extensions, particularly in the first movement, with the work of Beethoven as outlined by Bernstein disc already reviewed.

By comparison with the careful editing of Beethoven, Tchaikowsky must have been singularly lax in the art of self criticism, at least at this stage. To me this symphony represents little more than an exercise, and often a most interesting one, in the art he was to adorn much more brightly later on.

And, incidently, you need go no further than the last movement to hear quite clearly the composer's preoccupation with ballet music of which he wrote a good deal at this time.

Boult keeps the action going commendably—how some of those passages could drag!

The recording is quite good. It has a solid quality about it, and it's probable that the frequently massive scoring has much to do with this.

I think this is a symphony which you must like to enjoy or it may never persuade you very convincingly about its virtues.

With that reservation I leave it to you.

And while you are listening, an interesting game may be had guessing what the cover means.

* * *

HAYDN—Sonata in C major. MOZART—Sonata in D major, K576. Played by Solomon. H.M.V. BLP 1076.

This record was probably made at the same time as the Beethoven sonatas about which I was enthusiastic some months ago.

It has the same fine quality of piano tone which made them so good to hear.

Recording engineers have weighed reverberation and mike placement so that the sound is note-perfect—delicate where this is in order and yet able to take the full force of Solomon's arm with no trace of distress.

The result is bright, airy piano, with a minimum of hardness in the treble and a realistic depth in the lower strings.

The pianist takes much credit for this, as there are few in action today with such perfect control through a full range of dynamics, or who can produce such lovely legato.

I thought him admirably suited to these sonatas. He has understood the esssential difference between Haydn and the later Mozart, their different values of sophistication and emotional intent.

Only the very finest quality of touch could stand the examination of a closely miked adagio in the Haydn, for instance, every note so perfectly placed and balanced, the very pinnacle of musical architecture.

Without underrating the appeal of this record to the discriminating music-lover, I could imagine no better example or guide to the numerous piano students who tackle these deceptively easy pieces.

They come as near to the five-star award as they could without taking the honours. Some very faint surface clicks comprise the only flaw, and that a minor one.

Unreservedly recommended.

* * *

CHAUSSON—Symphony in B flat major Opus 20. Played by L' Orchestre de la Societie des Concerts du Conservatoire de Paris. BERLIOZ —Benvenuto Cellini Overture Opus 23. Played by the Suisse Romande Orchestra. Both conducted by Robert Denzler. Decca LXT 5244.

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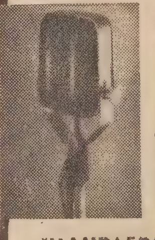
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fortunately I can't locate for the moment.

But if my memory is reliable, it was a much higher pitched job than this one, both sonically and emotionally. Not that I didn't like it—on the contrary I thought Paray did very well in building up an edifice difficult to assemble at any time.

Denzler has also made the music sound interesting and even impressive, and has done it more introspectively than Paray. I think as a result the symphony extends itself to the limits of complete interest, although the playing of the orchestra and the conductor's carefully nurtured dynamic lines do their best to assure us that the final chords will be worth waiting for.

It's probable that this French orchestra, in playing one of the very few French symphonies to be aired today, feels itself on its mettle, for I have rarely heard it to better advantage.

It is recorded from a medium distance and, although there is nothing startling in the sound, it is well balanced and has a good mid-distance frequency response and dynamic range.

The Suisse Romande plays vigorously and brightly as usual. Its recording isn't up to the best Ansermet standards, although this still leaves it with the edge on many others.

A good disc and, if only because of its extra item, might be preferred as the best Chausson yet.

BACH — Concerto for Two Violins and Orchestra in D minor, Concerto for Violin and Orchestra in A minor, Concerto for Violin and Orchestra in E major. Played by Reinhold Barchet and Will Beh (violins) with the Pro Musica String Orchestra of Stuttgart conducted by Walter Davisson. Vox APL-9150.

Some of the finest of music is on this disc. I found myself so absorbed that it was over before I began to collect my thoughts sufficiently to remember I was supposed to be reviewing.

So I played it all over again. Since then I have listened to it many times and liked it more each time.

Apart from the music, which is well able to speak for itself, I liked it for its sincerity and musicianship, its earnest lack of affectation and self-consciousness, all qualities which can overweigh many deficiencies.

Not that there are many of these. It isn't at all hard to follow most of the parts through the long, contrapuntal passages, although what has happened to the harpsichord I don't know. I heard not a single chord from it.

The group sounds just about right in size. The soloists are forward but not unduly so, as the miking is not close.

Particularly good is the slow movement of the double concerto which occurs at the end of side one.

There is nothing particularly brilliant or hi-fi about this record — nothing glamorous about the performers or the production.

But for all that, it might be very difficult to beat its charm and musicianship.

The surface is quiet and it is quite easy to play.

RIMSKY-KORSAKOV — Scheherezade Symphonic Suite Opus 35. Played by Morton Gould and his Orchestra. RCA L16077.

Once upon a time, an RCA disc was most probably synonymous with a dry, echoless thing of little charm.

It's different today.

Many American companies now appear to be exploiting the concert hall sound as opposed to the close and/or multiple mike technique.

I wonder whether stereo has anything to do with it? Practically every recording made today is taped in both single and double track, and it should be possible to use the single track for one of the stereo channels.

This wouldn't be successful unless there was enough reverberation present to allow the two-channel version to assume a three-dimension effect.

What more natural, therefore, than to think this way from the start?

For sheer brilliance of sound this disc doesn't equal Ansermet's effort for Decca some time ago.

But its capture of the concert hall flavour mentioned above is more successful.

What it lacks in force, therefore, it makes up for in spaciousness and breadth.

I don't know the composition of Morton Gould's orchestra, but my guess would be that it is a well-known performer under another name.

There is no distress at all in the quality of the sound. The solo violin is firm and forward. I would not claim extreme frequency range, and if it has less body than Ansermet's disc, that is part and parcel of the difference in recording method.

There is a slight groove echo on occasions and the starting grooves are a bit noisy.

ECHOES OF PARIS — ECHOES OF VIENNA — Played by George Feyer, piano with Rhythm Accompaniment. Vox AVX-500. AVX-550.

These are Piano-Rhythm records with a difference. George Feyer has a straightforward, intelligible style, sometimes mildly symphonic, frequently rhapsodical and always interesting.

One secret of his success is a strong and steady beat, and his use of straight harmonies.

This may not make him popular with the jazz intelligentsia, but I doubt if it's meant to.

The ordinary listener will undoubtedly go for them, none the less for the familiar tunes and the attractive way they are mixed together.

The pianist, who started out as a concert giver in his native Hungary, has long been popular with this style in Europe and America.

MOUSSOURGSKY — Pictures at an Exhibition. CESAR FRANCK—Psyche and Eros (Episode No. 4 from Psyche). Played by the NBC Symphony Orchestra conducted by Arturo Toscanini. RCA L16017.

Most people will be attracted to this record because it is Toscanini's version, for, although the famous conductor is now dead and gone, and the days of his achievements long past, his name will be enough to sell records for years to come.

In this case, there is no need to rely entirely upon the popularity of his name, for the disc has quite enough virtues of its own.

According to the jacket it was made in the Carnegie Hall in January, 1953, which makes it about 5 years old. As

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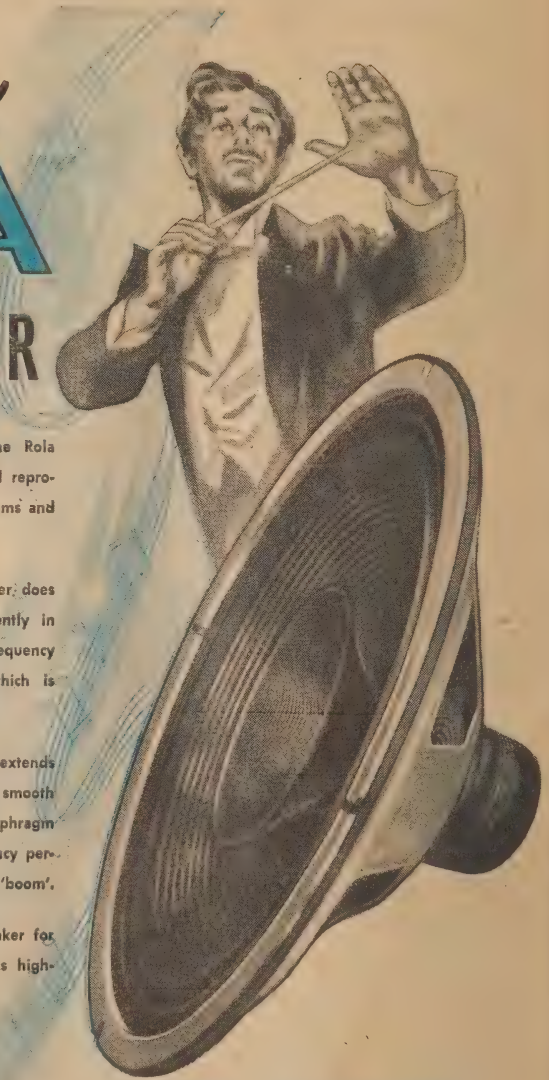

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with the historic Mercury version, it was recorded with a single microphone and, in fact, the sound has more in common with Mercury's than any other contemporary.

Compared with the latest Karajan Pictures it has much less richness and body, which is only to be expected. But that does not mean that it isn't extremely good.

As with all recordings of this type, it needs to be played at full volume to sound most impressive. With a little bass boost added, and the RIAA curve, there's no need to apologise for its age.

The brass, in particular, is very good.

Of all available versions, this one is musically the most carefully shaped. Toscanini's "Promenade" is more measured than usual, and his building up of atmosphere more deliberate.

He makes very little concession to the opportunities for sound exploitation beyond the natural requirements of the music but, because of good engineering and a good orchestra, these come to him in any case.

In its clear contrasts and distinctions between the moods of each section it is the best of them all, and I think you will find more to listen to as you get to know it.

Surface noise is not in any way annoying, but there is an undercurrent of smooth hiss if you are fussy.

The fill-up from Cesar Franck is quite a contrast but it is pleasant to hear.

PROKOFIEFF — Peter and the Wolf. DUKAS — The Sorcerer's Apprentice. SAINT-SAENS and EDWARD GERMAN — Henry VIII Dances. Played by the Boston Pops Orchestra conducted by Arthur Fiedler. RCA L16015.

It was a happy thought to couple Peter and the Wolf with the Sorcerer's Apprentice, for they have much in common, and even more so when Richard Hale adds a commentary to each.

The commentary is written into Peter and the Wolf and if I remember rightly, its first recording many years ago was made by this same orchestra with the same narrator.

He sounds rather older now, as undoubtedly he is, but I always liked his rather pompous, oratorical style—certainly better than others I have heard since.

It's so easy to patronise, or worse still to simper with a part like this.

Richard Hale is fortunate, too, in having an accent universally acceptable.

Peter and the Wolf I liked best. The recording here is very good. This is without doubt one of the best educational records about the orchestra in existence, and you will hear it in this instance almost at demonstration standard.

The instrumental tone is very spacious and clear.

The remaining performances seemed rather dull to me. The Henry VIII Dances I thought unimaginative.

Richard Hale's recitation before the Sorcerer's Apprentice was an interesting thought, although I doubt whether you will want to hear it right through each time, and it's pretty hard to pick the commencement of the music if you don't.

Fortunately, there is a scroll separating the end of the recitation and the music itself.

For what is on it, and the way it is handled, this should be a popular record.

SCHUMANN — Concerto in A minor Opus 54. WEBER — Concert Piece in F minor Opus 79. Played by Frederich Gulda and the Vienna Philharmonic Orchestra conducted by Volkmar Andreae. Decca LXT 5280.

This deft and well organised performance of the Schumann is a change from the perilously sentimental things we sometimes hear.

As the jacket note points out, it is possibly the composer's best work, but it needs to be handled firmly and sympathetically or it can easily lose itself.

Gulda tackles it with full confidence and great efficiency. In fact, if he were not such a good musician, we might even accuse him of slickness.

As it is, the concerto turns out smoothly, melodiously and well shaped; not too deeply plumbed and yet not lightly dismissed.

It is a performance which will always be heard with approval for its good manners, but it will not, I think, touch your heart as it might have done.

On the other hand it is always distinguished and safe.

The Weber is treated in much the same way. I first heard this work when Schnabel rehearsed it for a concert in the Sydney Town Hall, and he always delighted in it.

Gulda's style isn't a bit like Schnabel's, but he extracts plenty of melody and charm from it

ELGAR — Wand of Youth Suite Opus 1. Played by the London Philharmonic Orchestra conducted by Eduard van Beinum. Decca LXT 5279.

This recording I understand dates back beyond 1950 to the 78 rpm days, and was, in fact, in part, or in whole, redubbed from these discs.

It is fairly easy to pick its origin, because of extra surface noise which begins and ends with some sections. One of them still has traces of a type of distortion peculiar to records of that era.

If you use an ordinary radiogram, you might not spot these things, but on wide range equipment you could not fail to notice them.

It's only fair to say, however, that the performance is an extremely good one, and if made today would probably have been outstanding.

It hasn't the Elgarish sound that Boult, for instance, would have got from it, but there is no lack of delicacy or charm, or of robustness either, when that is called for.

Some of Elgar's loveliest music is found here, and much of it you are bound to know, for it is often played.

It isn't as good as today's standards, naturally, lacking particularly in presence.

This didn't worry me as much as the patchiness so difficult to avoid when a number of such items is grouped together.

It is quite probable that Decca intended this disc as an experiment to see how important these little defects would prove to be in the minds of the buying public. After all, many such experiments have been made in the past.

But why not have done the whole thing again? Both orchestra and conductor are still available.

Instead of a technically passable and musically good record, we could have had a beauty.

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SHORT-WAVE NOTES BY ART CUSHEN

B.B.C. BROADCASTS 24 HOURS A DAY

The increase to a 24-hour a day schedule for the BBC General Overseas Service and the move to new studios took effect last month in London.

THE General Overseas Service from London is the only service in the world which now broadcasts in English around the clock and the step up from 21 to 24 hours a day will be appreciated by listeners throughout the world.

The GOS was on a 24-hour a day basis throughout the war but an economy cut after that period reverted the broadcast to 21 hours each day. The service to Australia and New Zealand will be particularly beamed on this area from 4 p.m to 9.30 p.m. and again from 6 to 8.15 a.m.

The Pacific Service, a regional program for this area, will continue to be broadcast and is transmitted from 6 to 6.45 p.m.

The studios of the General Overseas Service have been located at 200 Oxford Street, London, for some 15 years, and now it shares the building with the European Service. A move has been made to new studios at Bush House, Aldwych.

The General Overseas Service is now broadcast to Australia and New Zealand as follows:

4-7 p.m. on 11955, 15310 Kc.
7-9.30 p.m on 17810, 21550 Kc
7.15-9.30 p m. on 17870. 21490 Kc.

The above is for this area, but additional transmitters will be on the air for the Middle East and South Africa, which will also have an extended coverage. The coverage for Africa and the Middle East, which was from 2.30 p.m in the past, will now be from 1.30 p.m and the coverage for the Americas which, in the past was to 1 p.m., has been extended to 1.45 p.m

The Pacific Service which in the past followed the normal sign-off at 6 p.m. on the General Overseas Service, using the same transmitters, will now be heard on new frequencies in the 19 and 25 metre bands from 6 to 6.45 p.m

HANOI USES 4780Kc

THE reception of the Voice of Vietnam broadcasting from the Communist-controlled Northern Vietnam on the 60 metre band was indeed a surprise to us when listening at 1 15 a.m. and the station was then heard to carry a program in English for 30 minutes. The news and commentary was followed by music and at 1.45 a.m the station then reverting to local language programs. The signal was received strongly and the frequency was not announced, though the transmission was also carried on the normal Hanoi frequencies of 15020, 12000, and 9460 Kc. Other signals from Asian stations dominated the band and the nearby Thai National program on 4730 Kc was also heard closing at 1 35 a m with an English announcement.

BANGKOK ON 4883Kc

SIGNALS from the Bangkok station HSK have been heard on 4833 Kc when the station signs off at 1.35 a m at fair strength. The station, though using only 1,000 watts, is received clearly as, at that hour, the band is free from the Indonesian stations which mainly close at 1.30 a.m. The closing announcement gives the frequencies which are in operation at the time and they are all of low power, making reception of them rather remote. The station is using 15600, 11910, 7140, 6040 and 4833 Kc shortwave and medium wave frequency of 835 Kc. The stronger overseas service from Bangkok is still heard well on 11670 Kc. with English news at 8.30 p.m

NEW CAIRO SCHEDULE

THE Egyptian Broadcasting Service at Cairo has introduced a new transmission schedule which is now in operation and is as follows:

ARABIC MAIN PROGRAM:
2.15-5 p.m., 9795 Kc: 10 p.m.-11 p.m on 7050 and 11670 Kc
12.45-8 46 a m. on 9795 Kc
VOICE OF ARABS AND SUDAN:
1.30-2.20 p.m., 2 30-3.30 p.m., 9-10 p.m., on 7050 Kc.
12.30-3.30 a.m., 3 40-8.15 a.m. on 11670 Kc
4-4.35 a.m., 6.30-8.05 a.m on 17915 Kc.
NORTH AMERICA: 9.30-11 a.m on 9795 Kc
SOUTH AMERICA: 9.30-11 a.m. on 15465 Kc.
EAST ASIA and IRAN: 9 p m.-12.30 a.m. on 17915 Kc.
EAST AFRICA. 12 45-2.45 a.m on 17915 Kc.
EUROPE: 5-6.20 a.m on 17915 Kc, English news at 6 a.m. Reports on reception should be sent to the Monitoring Department, Egyptian Broadcasting Service, Cairo, Egypt

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, N.Z. All Times are Australian Eastern Standard Time.

SOUTH KOREA

THE broadcasts from this country, since the installation of the new 100 kw transmitter are now widely reported, and the prompt confirmation of reception by the Voice of Free Korea, is appreciated by listeners. The station has been well received in the past few weeks on three frequencies, 11925, 9760, and 7935 kc. The special transmission to Hawaii 3.30-4.30 p.m on HLK6 on 11925 kc has also been heard as well as the session 6-7 p.m on the same frequency, and both these transmissions carry the first 30 minutes in English. The HLKA transmitter on 9640 kc. has news in English at 8.30 p.m., while on Saturdays and Sundays the station has been heard from 5.30 to 6 30 p.m., with popular American recordings. This program has announcements in English, while a further HLKA transmitter on 7935 kc. has been noted from 8 p.m. to midnight; this station has also been noted with the news broadcast in English at 8.30 p.m

BEIRUT, in the Lebanon, has been measured on 8010 kcs by a listener in the U.S.A., who reports the station opening at 2.45 p.m.; the station has been listed on 8030 kc. in the past.

BURMA broadcasts from Rangoon are again in the news, being reported with the English transmission each day from 12.15 to 1.15 a m on 11765 kc., while a report states that they are also using 9545 kc. for the same transmission. When the station first came on the air, the report of this frequency was also made, but checks here revealed that the announcer was referring to the broadcast band frequency of 954 kc. The station, has not to our knowledge, verified any report on this new high powered transmission which was put into service about a year ago.

TRANSMISSION SCHEDULES

FROM LOS ANGELES

The broadcasts from the Armed Forces Radio Service at Los Angeles, California, are heard very well in this area, in the new schedule of 11.00 a.m. to 1.00 a.m. The transmitters in use are all station KCBR, and the present schedule as supplied by Kevin Dunham, NSW, has been revised with some last minute changes and the broadcasts are now released as follows

KCBR5 15310 Kc. 11.00am - 4.30pm.
KCBR3 17850 11.00am-5.00pm.
KCBR2 9700 5.30pm-1.00am.
KCBR1 21740 11.30am-4.30pm.
KCBR4 15290 4.30-5.30pm.
KCBR5 9570 Kc. 5.00-10.00pm.
KBCR2 9700 5.30pm-1.00am.
KCBR3 11870 5.30pm-1.00am.
KCBR5 15315 Kc. 10.15pm-1.00am.
KCBR5 17880 8.00-10.45am Sundays

FROM COLOGNE

The latest schedule from the Deutche Welle station in Cologne in Germany is now as follows.

FAR EAST 5.00-8.00pm on 21650, 11795 Kc.
NEAR EAST 12.30-3.30am on 21490 17815 Kc.
AFRICA 4.00-7.00am on 17815, 15275 Kc.
SOUTH AMERICA 8.00-11.00am on 11795, 9640 Kc.
NORTH AMERICA 11.30am-2.30pm on 9640, 5980 Kc.

FLASHES FROM EVERYWHERE

DUMAGUETE CITY in the Philippines is the home of stations DYSR(840), DYB4(3277) and DYH4(6055) and recent reports show the present schedule of the stations to be as follows: Sundays, 7 a.m. 4 p.m., and 7 p.m. to 1 a.m. on Monday, while other days the station is broadcasting 7 a.m. to noon, and from 8 p.m. to 1 a.m. The transmissions are best heard in this area on the DYB4 station when they open at 8 p.m and this is normally with a news broadcast. The station can be reached by reports to P.O. Box 1767 Manila or to the studios at the Silliman University in the Dumaguete City

SOUTH KOREAN stations are listed in a letter from Arthur Harris, in Benellu, Victoria, who states that the first network of the Korean Broadcasting System is comprised of stations on 710 Kc, 100 Kw, 3910 2Kw, 2510 10 Kw, 5980 10 Kw, 9640 50 Kw and 7936 Kc 10 Kw. The second network is on 970 100 Kw, 7180 1 Kw, 9640 50 Kw. Programs in English, Chinese and Japanese are included in the broadcasts of the second network. English is from 8.30-9 p m on Monday to Friday. Chinese from 1-1.30 a.m., and Japanese from 11 to 11.30 p.m. daily. Listeners in North America and Hawaii are also covered in broadcasts on HLK6 on 11930 Kcs, and these programs are on the air from 3.30 to 4.30 p.m. and from 6 to 7 p.m., with English comprising the first 30 minutes of the transmission

PAKISTAN broadcasts on the facilities of Radio Pakistan in Karachi and is now broadcasting in English on 15335 and 11885 Kc from 10 to 11 15 a.m., 6.30 to 7.15 p.m on 21590 and 17750 Kc, 8 45-9 p.m. on 21590 and 17750 Kc, 1.30-1.45 a.m. on 11914, 15145 Kc, 4.15-6 a.m. on 11675, 9705, and to the United Kingdom from 5.15 to 6 a.m on 9705. 7285 Kc

HELSINKI is to commence special sessions for DX listeners overseas, and the transmissions from Finland will be heard on the first Tuesday of each month, reports a correspondent to Radio Australia. The session will be in the North and South American transmissions which are released at 9.30 p.m. and at 11.30 p.m on 01X4, 15190 Kc, and 01X5 on 17800 Kc.

VATICAN RADIO now operates a new 100 Kw transmitter from a site 10 miles north of Rome and the transmissions are to be directed to Africa Asia, and North and South America over these new facilities. The Philips 100 Kw transmitter which has been installed is the forerunner of several other transmitters which will eventually be added to the transmitter array for the Vatican station

ELWA in Monrovia, Liberia, has again been reported at 3 a.m. on 11980 Kc, having moved from 11700 Kc to this frequency. The 31m band frequency of 9655 Kc at 11.30 a.m. in English news, and the 13m channel of ELWA on 21510 Kc heard at 9.30 a.m and again at 11 a.m.

ADDIS ABABA in Ethiopia, which has so far eluded most listeners in this area, is now reported to be using frequencies of 6183 and 5058 Kc, in its service from 3-4 a.m when the 6183 Kc transmitter closes.

The 5058 Kc station continues in use to 5 a.m., with programs from Addis Ababa in Arabic and English, reports Radio Australia. The session, 4.25 a.m.-5 a.m. consists of popular Western music with announcements in English. When closing at 5 a.m. the announcer has been heard to state that the station is on the air every night to 10 p.m. East African time.

FINLAND'S transmissions from Helsinki has been heard by Australian listeners on the unusual frequency of 17960 Kc from 9.15 to sign off at 9.45 p.m.; signals have been only fair and there is considerable interference on the frequency.

MAURITIUS is to install a new 10 Kw transmitter at the Forrest Side site, reports a listener to Radio Australia. The Mauritius station will use this transmitter for its international broadcasts. The country at present is only heard on the 15040 Kc channel, when they are using only 1500 watts from 1.24 p.m. to sign off at 2.7 p.m.

BRAZIL'S new station at Porto Alegra has moved from the old 9730 Kc frequency and is now operating on 15335 Kc. The station reports that the move was caused by severe interference on 9730 from H12T in Ciudad Trujillo, in Dominican Republic, which also operates on the same frequency. The station, in verifying the letter to a Danish listener, states the schedule is 11 p.m.-3 a.m., 5 a.m.-8.30 a.m., and 9 a.m.-1 p.m.

URUGUAY has been noted with a test transmission to Europe with the announcements in German, French and English, and the station has been using 15385 Kc, from 8.30 to 8:34 a.m. The station is CXA60, Radio Ferande at Montivideo. The station is commercial and plans to start a regular transmission to Europe.

THE HAM BANDS WITH BILL MOORE

BERU CONTEST ARRANGED FOR HOLIDAY WEEKEND

The BERU contest always provides contacts of interest to Australian amateurs. Many British Commonwealth prefixes are rarely heard and this contest provides an opportunity to contact these elusive stations.

THE twenty-first Beru contest wili be conducted over the Australia Day weekend, and again the simplified rúles introduced in 1957 will apply Only minor alterations to the wording are incorporated this year to clarify the meaning of a number of rules.

High maximum useable frequencies should see the 14, 21, and 28 mc. bands offering excellent DX working and scores will be high

Last year's contest was very popular. over 550 Commonwealth stations taking part in more than 50 of the listed call areas Winner was Vic Williams. VE3KE; in second place was George Dent, VQ4AQ. who has won the contest on a number of occasions. Leading Australian stations were Jim Rumble. VK6RU, in ninth place and Lyell Woolnough. VK2GW. in tenth place

CONTEST RULES

Rules for the 1958 contest are as follows:—

1. The contest is divided into two sections, namely (a) High power—maximum licensed power: b) low power—maximum 25 watts input.

2. The contest (both sections) will start at 0001 G.M.T on Saturday, Jannuary 25, and end at 2359 G.M.T. on Sunday, January 26, 1958.

3. The contest is open to all fully paid up members of the R.S.G.B. within the United Kingdom. to all British subjects outside the U.K but within the British Commonwealth, and British mandated territories. and to members of British orces of occupation operating properly authorised tations All entrants agree to be bound by he rules of the contest

4 Only the entrant will be permitted to operate he station for the duration of the contest.

5. Entries must be set out as shown in the ex-mple, using one side of the paper only. Entries must be post-marked not later than February 0 1958, and must be addressed to the Contests Committee, Radio Society of Great Britain. New Ruskin House, 28/30 Little Russell Street, Lon-on, WC1. The closing date for the acceptance f entries is March 31, 1958.

6. Operation is restricted to the following bands. .5, 7, 14, 21, and 28 mcs. Transmissions must e of type A1 (pure C.W.) only and frequent one reports of T8 or less might result in dis-ualification.

7. Entrants must operate within the terms of heir licences. The input to the valve or valves elivering power to the aerial must not exceed 5 watts in the low power section.

8. Contacts may be made with any station using British Commonwealth or DL2 call-sign, except ontacts within the entrant's own call area British sles stations may not work each other for points nd contacts with unlicensed stations in places here licences are obtainable will not count.

The decision as to whether or not a station is valid will rest with the R.S.G.B.'s Contest committee Only one contact on each band with a specific station will count for points. Duplicate contacts should be logged but no points claimed

9. Each completed contact will score 5 points In addition a bonus of 20 points may be claimed for the first contact with each Commonwealth call area (as defined in the list) on each band All British Isle Stations, G. GC. GD. GI. GM and GW) count as one call area

10 Serial numbers must be exchanged and acknowledged before a contact can count for points. The serial number of six figures is made up of the R.S T. report plus three figures which may start with any number between 001 and 1000 for the first contact, and increase by one for each successive contact.

11. A trophy or miniature will be awarded to the winner in each section and certificates will be awarded to the first three entrants in each section In addition a certificate will be awarded to the leading entrant in each call area providing his score exceeds 1,500 points in the high power section of 750 points in the low power section. A certificate will also be awerded in each call area in which there are 10 or more entrants. provided his score exceeds the above tallies

RECEIVING SECTION

1. To count for points the log must show, in columns. a. date: b, band; c, time GMT; d, station heard; e. serial number sent: f. station worked; g, points claimed: h, bonus points claimed CQ or test calls will not count for points.

2. Each logging will score points in the same way as contacts in the transmitting contest (see Rule 9 earlier)

3. The same station may be logged only once on each band.

4. Logs must be addressed and postmarked as for entries in the transmitting contest.

The following call areas are recognised for purposes of scoring in the Beru Contest:—

G, GC GD. G1, GM, GW—as one call area MP4 (Bahrein, Muscat and Oman). MP4 (Qatar), MP4 (Trucial Oman), VE1, VE2, VE3. VE4, VE5, VE6, VE7. VE8A-L (Yukon Territory). VE8M-Z (N.W Territories). VKO (Australian Antarctica). VKO (Heard Island). VKO (MacQuarie Island) VK1, VK2, VK3. VK4, VK5, VK6, VK7. VK9 (Norfolk Is.), VK9 (Papua). VK9 (New Guinea, Bismark and Admiralty Islands). V0. VP1. VP2 (Leeward Islands), VP2 (Windward Islands), VP3, VP4. VP5 (Jamaica), VP5 (Cayman Islands), VP5 (Turks and Carcos Islands). VP6, VP7. VP8 (Falkland Islands). VP8 (Grahamsland), VP8 (Sandwich Islands), VP8 (South Georgia), VP8 (South Orkney Islands), VP8 (South Shetland Islands), VP9. VQ1, VQ2, VQ3. VQ4, VQ5, VQ6, VQ8 (Chagos). VQ8 (Mauritius), VQ9, VR1 (Gilbert and Ellice Islands). VF1 (British Phoenix Islands), R2, VR3, VR4, VR5, VR6, VS1, VS2. VS3, VS4, VS5, VS6. 9 Aden, VS9 (Maldive Islands), VU2, VU4, ZB1, ZB2, ZC2, ZC3, ZC4, ZC5, ZD1, ZD2, ZD3, ZD4, ZD5, ZD6, ZD7, ZD8, ZD9, ZE, ZK1 (Cook Islands), ZK2, ZL1, ZL2, ZL3, ZL4, ZM6. ZS1, ZS2, ZS3, ZS4, ZS5. ZS6, ZS7, ZS8. ZS9. AP ST2, 4S7 and DL2.

Log sheets should show: Name of operator, contest section entered, claimed score, address, call sign, transmitter, input power to final stage, information on receiver and antennas used.

Operating information should be listed in this order: Date, band used, time GMT, call sign of station worked. my report of his signals, his report of my signals, points claimed, bonus points claimed, and a blank column for log checking.

N.S.W. FIELD DAY

THE N.S.W. Division's Combined Hunter Branch and Sydney Section's Field Day, held at the new venue. Gosford, in November, was extremely successful. over 250 attending and nearly 100 amateurs and associates registering.

The Sailing Club's rooms at Gosford provided an excellent setting for the day and next year's event is certain to see an even greater attendance The hosts for the day were the newly formed Central Coast Amateur Radio Club, whose members organised all aspects of the event.

Registration was in the hands of Rex Black, VK2YA, club secretary. Reg Brooks, with his amplifier-megaphone acted as organiser, while president Major Collett, VK2RU, was busy in many ways, assisted by all members.

Ray, W2LNY. travelled the furthest distance to attend and was presented with a book on Australia autographed by all the amateurs present.

The 40-metre scramble was won by Bill Hall, VK2XT, with 16 contacts in the half-hour contest period In the second place was another stalwart scramble operator Harold Whyte, VK2AHA.

Conditions on the band were extremely poor but 16 contacts in 30 minutes is an excellent performance.

The other field event, the 144 mc/s hidden transmitter, resulted in a win for Dick Norman, VK2ZCF, who located the "fox" in 15 minutes, Bob Godsall, VK2ARG, ran into second place. Eleven cars set off on the search and a number were soon "bushed" by the meandering roads and streams.

The VK2WI Sunday broadcast was conducted from the field day site from VK2ARG's mobile station on 144 mc/s.

The transmission was rebroadcast by local amateur VK2RU on the normal frequency of 7146 kc/s.

The Disposals Committee, Alec Dan, VK2ABU, Allan Williams, VK2FH, and Harry Solomons, VK2AJZ, were in their usual good form at the auction and a number of amateurs left with large parcels of equipment.

The local ladies. Mesdames VK2RU, VK2AEZ and VK2ND. were to the fore in providing a continuous supply of foodstuffs.

The program arranged provided plenty of time for general discussions, a feature greatly enjoyed by the many amateurs present.

Woy Woy assistant organiser. Johnny Walker, VK2GA, was evident in his usual position, but missing was Rod Pike, VK2ACU, and it is hoped Rod will be in better trim for the next event. All attending enjoyed the "do," it was one of the most entertaining of these events.

The Central Coast Club's AOCP Class now comprises 36 members and lecturers are schoolteachers Rex Black, VK2YA, and John Deering, VK2ND. Amateur activity in the Lakes District is extremely high and with so many intending amateurs the QRM level will ultimately reach city proportions It is pleasing to see such interest in the hobby

W.I.A. EMERGENCY NETWORK

WICEN organisation is proceeding rapidly in .S W., and already over 70 members are listed various areas in that State. For many years ow the work of N.S.W. amateurs in the W.I.A et in emergencies is well known.

They have an extremely fine record in the ublic service but it is now intended under WICEN go further and members will be required to able to provide H.F and V.H.F. equipment r use in all emergencies—flood, bushfire, or civil efence working. Simulated tests will be con-ucted with emphasis on C.D. communication re-uirements.

No. 122 sets will be made available through /.I.A. disposal channels at a reasonable cost all net members to cover H.F. working on e 3.5 and 7 mcs. bands. These units comprise 807 final modulated by a 6N7. and an effec-ve V.F.O. and receiver

It has been decided to use the 56 mcs. band r use in V.H.F. communication and members ill be asked to provide a base/mobile unit for e on that band as well as walkie talkie unit esigns for both have been prepared and ai-sted by State Emergency Co-ordinator. Bob God-ll, VK2ARG.

It is hoped that these units will. as far as ossible, be standardised to provide the advan-ge of interchangeability, if circumstances re-ire it.

The net will in country areas co-operate closely th the local civil defence authority—the area ire or council. Already a number of WICEN embers have been elected as the Civil Defence ommunications Officer for their district.

Following the disastrous bushfires on the Blue ountains in early December, the first meeting WICEN members was held.

At Springwood on December 6, communications during the emergency was discussed. It was apparent to all that fought the fires during the two weeks that amateurs could certainly assist by providing and operating equipment during these emergencies. Effective communictior will always be a problem due to the rapid change of fire fronts and the fact that personnel have by reason of necessity to move so quickly. Fire watching and tender movements could undoubtedly be assisted

Some radio equipment was available The R.A.A.F., who provided hundreds of firefighters. brought their own transceivers

State W.I.A president, Perc Healy, VK2APQ and State Emergency Co-ordinator, Bob Godsall VK2ARG. attended; also present were VK2EX VK2ABK. VK2NK, VK2MZ. VK2QA, and VK2HZ. It was decided to concentrate on the immedate establishment of 56 mcs. links to cover bushfire, C.D., and WICEN working.

In the Blaxland area Wal, VK2MZ, and Norm VK2QA. have already completed three walkie-talkie and a base station on 56 mcs for assistance in fire fighting in that area.

At Lawson, Keith King, VK2ABK. and Dave Melbourne, VK2NK, will provide the necessary 56 mcs. links, the latter amateur has been appointed communications officer for C.D in the City of Blue Mountains.

Peter Adams, VK2JX. was the only amateur who lost property during the fires, when his garage was burnt. Fortunately, his home the only one standing over a wide area, was undamaged Peter's accumulation of radio gear, after 30 years of amateur radio activity, was incinerated, but the main equipment was in the house.

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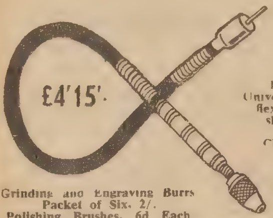
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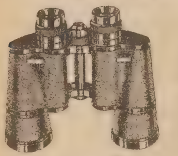

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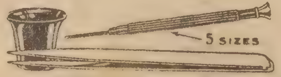

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PRICE: 7/3. Packing and postage, 3/6.

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R.A.A.F. Type . . . . **Price: 10/6**
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Magnifying glasses, 8 mags., **8/6;** 10 mags., **12/6.** Tapped Transformers, 6, 12, 18, and 24 volts, 3 amps, **45/;** Tweezers, **5/6.** Watchmakers' Eyeglasses, **6/6;** extra strong, 10 mag., **15/.** Set of five Watchmakers' Screwdrivers, **13/9.** American Oxywelding Torches, **£5/10/.** 24 volt, 1,500 watt Generators, **£12/10/.** Brand new 0-1 English Micrometer, **18/6.** Ball Bearing Stepdown Gear Box, **39/6.** Steel Masons' Squares, 24 x 12, **14/6.** Pope 5½in Steel Planes, adjustable, **52/6.**
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Packing and Postage, 3/6; interstate, 5/.

SLEEPING BAGS, WITH HOOD

PRICE: 79/6. Packing and postage, 3/-; interstate 6/.
Ideal Bag for Campers.

Safety Belts, As Used in Aircraft. Highly recommended for car trials. Quick-release catch. Complete with body harness. **Price: 19/6 each.** Packing and postage (all States), 3/6.

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No. 605: 7½in long, 1½in wide. In cardboard case, **55/.**

No. 450: 6in x 1in. Fitted with magnifying cursor. In leather pocket case **50/.**

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No. 28: (Circular type). Diameter, 3in. In plastic cover, 25/.

These Slide Rules are complete with Instruction Manual.

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TELESCOPES, GOING CHEAP

20 magnification, pigskin carrying case, pocket size, very handy, **£5/5/.** 30 mag., with tripod, **£10/19/6.**
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Ex-R.A.A.F. Takes Standard Gosport tube.

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Gosport Tubes, **50/.**

Listen for trouble in your car or machines.

STETHOSCOPES WILL DETECT ENGINE-KNOCKS

PRICE: 35/. Packing and postage (all States), 5/.

THE 1958 annual Hamfest of the N.S.W. Division of the W.I.A. will be held in the grounds of the VK2WI site at Quarry Road, Dural. As usual, the event will commence with the January monthly meeting at Science House on Friday, January 24.

The Saturday afternoon and evening sessions will be at Dural. A comprehensive program covering lectures, films, competitions and the usual disposal distribution.

The transmitter site of some five acres will provide an excellent location for this type of amateur activity.

A buffet tea will be served and amateurs attending will have the opportunity of meeting country amateurs. Remember the Hamfest, Dural, Australia Day weekend.

SODIUM CLOUD

"OPERATION Smoke Puff" (Nov. issue) commenced on Nov. 26th when a sodium vapour cloud was released some 80 miles up in the sky. Amateurs were alerted of the firing of the "Aerobee" rocket by a special signal transmitted from the Air Force Missile Station in New Mexico.

They then beamed their signals towards the cloud and will collect as much information as possible on the reception of signals reflected by the cloud. The "Aerobee" travelled at 3,600 miles per hour on its journey to release the cloud, which was visible for many hundreds of miles.

The announcement that signals had been bounced back off the moon made at the International Scientific Radio Union will be of interest to VHF operators.

Experiments first commenced in 1951 with a megatwatt transmitter operating on 200 mc/s, 10 micro second pulses were used and the antenna was arranged above a parabolic shaped hole 250 feet in diameter, formed in the earth.

In February of last year reflections were successfully recorded using a 3,000 mc/s signal of 2 micro seconds duration.

The round trip of 500,000 miles took 2½ seconds. The signals received were weak but easily identified.

EMERGENCY POWER

OFFICIAL Station VK2WI will shortly be completely independent of public mains supply on the installation of a 25 KVA alternator purchased by the division.

The alternator is driven by a V8 engine and will assure the station can be operated in any emergency, one of the original objects for the building of VK2WI.

A new 7 mc/s band antenna has greatly improved the general coverage; it is a centre fed dipole 50 feet high.

VK2WI, using 300 watts input, is now providing a readable signal under adverse conditions. 7 mc/s in daytime during the summer often provides poor conditions, but this year signals have always been intelligible at this location. In previous years, with lower power and a not so effective antenna, signals were practically inaudible on many Sundays.

Another piece of equipment recently presented to VK2WI is a bench and vyce—the donor Dave Evans, VK2AYE.

N.S.W. DIVISION

LECTURER at the November meeting of the N.S.W. Division was Neville Williams, VK2XV, and the subject "TV Receivers." Neville covered the various requirements for construction of such receivers from the antenna onwards.

Available for inspection were many items of TV equipment including complete 21-inch and 6-inch units. Reception was excellent with a simple indoor antenna. The lecturer undoubtedly influenced many amateurs into seriously considering the construction of their own receivers

LIBRARY NOTE

THE N.S.W. Division's Library is soon to be extended and approval has been granted for the purchase of many modern handbooks covering recently developed radio techniques. These will include all the smaller handbooks on specialised subjects. Inquiries can be addressed to the Librarian, Box 1734, G.P.O., Sydney.

A surprise 144 Mc/s scramble conducted at the completion of the VHF VK2W1 Broadcast on December 1 resulted in a win for John Lark, VK2ZAV, second, Jim Cummings, VK2PM.

The November evening hidden transmitter search on 144 Mc/s with Bob Winch, VK20A, as the fox, was won by Jim Cummings, VK2PM, in 50 minutes.

Second place, Phil Pearson, VK2ZBB, 78 minutes, and John Miller, VK2ANF, third in 79 minutes.

50 Mc/s is providing plenty of DX and in one session Bill Cooper, VK2AQI, of Armidale, made 14 interstate contacts in a few hours. The MUF is expected to rise to 48 mc/s in January and some real DX may be expected. John Peell, VK2WJ's contact mentioned last issue was with KH6, not W-land, and a repeat of this record could easily be attained.

Jerry Miller, K6[illegible]DK, interviewed over VK2WI by State president Perc Healey, VK2APQ, provided an interesting insight into features of amateur activity in the U.S. One point of importance was the method of combating TVI.

This work centred around special committees formed by the many radio clubs located throughout the country. In cases of TVI not readily solved the appropriate club committee is informed of the problem by the FCC and they then investigate the complaint.

These committees are fully informed on the subject of TVI and members visit the viewers and explain reasons for the interference and cures.

The committees are in close liaison with TV receiver manufacturers and keep them informed on any unusual cases of TVI that could be directly attributed to faulty receiver design.

Jerry also mentioned that second-hand TV receivers could be purchased for as low a price as £7 10/ and that the cost of new receivers varied between £50 and £70. New colour receivers cost £200

He also discussed the various classes of licences granted and sympathised with VK amateurs on the dearth of special amateur equipment.

DX NOTE

THE DX fraternity have been interested in rare DX station MIH on the 21 mc/s band. He generally operates around 21,120 kc/s, and is audible in the evenings. The signal arrives at better strength via the Long Path than the short Unfortunately, short skip has been evident in Europe and MIH was mainly working stations in that continent. His OTH, Box 8081, REP San Marino

FIELD DAY

SOME of the rules for the National Field Day, published in the December issue, have been varied and the following are the amended sections:—

There shall be six sections in the contest—

a. Single operator portable and mobile transmitting phone.

b. Single operator portable and mobile transmitting CW

c. Single operator portable and mobile transmitting open

d. Multiple operator portable and mobile transmitting.

e. Fixed stations working to mobile and portable stations.

Scoring table:—

Portable and mobile stations:

a. For contacts with fixed stations within the competitor's own State—2 points

b. For contacts with fixed stations outside the competitor's own State—3 points.

c. For contacts with other portable or mobile stations within the same State—5 points.

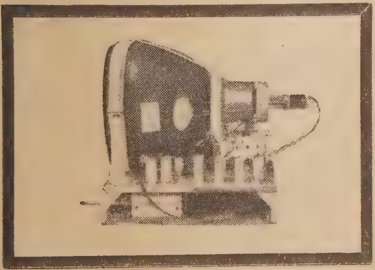
d. For contacts with other portable or mobile stations outside the competitor's own State—10 poins.

In the case of entrants in the multiple operator section several bands may be used simultaneously.

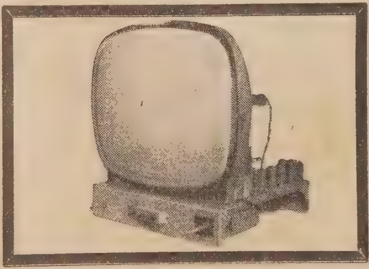
Build your own cabinet—or have it built into your furniture

COMPLETE TV CHASSIS

Here is the opportunity for you to buy a brand new TV chassis, and build your own cabinet or build it in to your furniture. Both 17" x 21" screen sizes are available, using only top quality local and imported components. The sets are all fully tested and aligned, and there is a 3 months warranty on valves and all components, 6 months on the picture tube.



17" - 23 Valves, Anodeon picture tube. 4-stage IF strip. Front Tuning. £123/18/0 complete.



21" - 23 Valves, Ratheon picture tube. 4-stage IF strip. Front-tuning. £140/18/0 complete. Side tuning, vertical chassis 21"-£155 complete.

Extras available:
Special 21" mask £1/17/6.
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Knobs — set 4, £1/12/6.
Back cover, 8/6.
Optical filter glass—order to size, price on application.

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Incorporating Mullard 5/10 bass boost amplifier, treble boost dual wave tuned R.F. stage. Built-in pre-amplifier for microphone or tape recorder including Jensen twin speaker.

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CHECK THESE EXTRA FACILITIES

Built-in Pre-amplifier to suit crystal microphone tape deck, electronic guitar, sound on film, TV, etc. Hear it demonstrated on these units.

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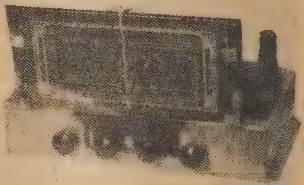

Dual wave, 6 valve radiogram chassis includes bass and treble boost, 12in Jensen or Magnavox speaker.

£23/15/-

8 VALVE RADIOGRAM HI-FI CHASSIS

Dual wave, bass and treble boost, tuned R.F. stage, 12in speaker.

£28/17/6

AMPLIFIERS

PUBLIC ADDRESS RANGE 240-AC

6 valve 10 watt ..	£14/17/6
6 valve 25 watt ..	£25/7/6
6 valve 40 watt ..	£32/7/6

BATTERY ONLY OPERATION

6 valve	6v	10w	£18/15/-
7 valve	12v	10w	£19/15/-
7 valve	12v	25w	£24/17/6

BATTERY AND A.C. OPERATION

6 valve	10w	6v	£20/15/-
7 valve	12w	12v	£21/15/-
7 valve	25w	12v	£29/7/6

HI-FI RANGE MULLARD 5/10

£34/15/-

Complete with Jensen twin cone speaker, Ferguson O.P. transformer, 301 and U.I. taps.

MULLARD 5/20 as Above.

£42/15/-

Tuner and separate control box with mike pre-amplifier.

£12 extra

CHASSIS FOR 17 OR 21in TV

Complete with EHT Box and Brackets	£3/12/6
Chassis for 5in. ..	£1/17/6

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R TV & H KITS

Complete Kits

17in with wired and tested Steanes Strip and Philips Turret.

£108

21in as above £118

5in. RT & H KITS

5in R. TV and H. Kit modified for 6in VCR97 .. £62

STRIPS & COILS

Steanes. Pre-aligned.

Mark 1	£20
Mark 2 with limiter ..	£23

STEANES KIT OF COILS

For Mark 1 with chassis sockets and Circuit Diagram, £6/10/-.

Mark 2 .. .. £7/7/-

RCS STRIP KIT

For 17in or 21in ..	£7/5/-
For 5in.	£6/17/6

NEW ALTEC LANSING. THEATRE H.F SPEAKER UNITS.

£20

R. T. & H. 21" TV CHASSIS

Now on display at Newtown and Collaroy.

SEE IT IN OPERATION

The complete kit of parts including wired and tested Steanes or R.C.S. I.F. Strip and Philips Turret Tuner.

£118

Console or TV Gram Cabinets to suit.

Set can be supplied wired and tested.

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COMPLETE RANGE OF ANTENNAS

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£11/17/6

4 SPEED CHANGERS

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5 VALVE RADIOGRAM CHASSIS

DUAL WAVE 12in. SPEAKER

£18/15/-

5 valve also available as home constructors' Kit Sets. **Complete with circuit.**

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7 VALVE DX RECEIVER

3 band, 2 to 6 to 18 megs 160 to 16 metres and broadcast. Exceptional selectivity, sensitivity 2 microvolts. **New Australians,** listen to European short wave stations.

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ALUMINIUM CUT TO SIZE

16 Guage 6/- sq. ft.
18 Guage 5/- sq. ft.

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With 5-Valve, Amplifier, Speaker, Crystal, Mike.

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With Built-in Tuner Amplifier

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Only the Cabinet required for Hi-Fi Tape Recorder.

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Communication
Electronics

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AND 636 KING STREET, NEWTOWN

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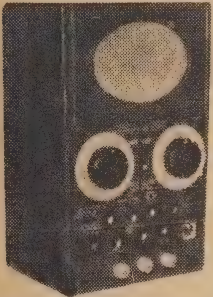
DULWICH HILL, UNDERCLIFFE, EARLWOOD, TRAM AT DOOR, STOP No. 42



AR8 Communications Receivers

12 valve. Converted to 240v. A.C. Thoroughly Tested, Re-aligned. Latest Ovaltone Permag. Speaker.

£34/17/6

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100 assorted. 40 Values.

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Postage 2/6.

NEW CONDENSERS

25 P.F. to 30 MFD. 100 assorted. Mica Paper Electro.

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Postage 3/6.

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Series wound Hi-speed miniature, 12,000 RPM	£2/10/-
Shunt wound with gear box, 2 speed and 5 and 25 RPM	£2/10/-

12 VOLT GENERATORS

New C.A.V. 80 amp. Generators. Ideal for lighting or fast charges.

£10/10/-

Throat Mikes. New	3/6
12v. 420 watt Prefocus Globes	7/6

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All tested on TV picture.

3BP1 with shield and socket,	£3/17/6
VCR 97	£2/17/6
ACR2X and Shield	£3/0/0
CV 112 White, 5in	£3/10/-

12DP7. 12in Magnetic Deflection and Focus. Blue Screen.

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Every tube capable of perfect picture. Fast persistency and simple construction, using standard components.

NEW 3BZ TRANSMITTERS

12v. operation. 2 to 10 Megs. Air tested. Perfect order. Complies with P.M.G. requirements. For small ships, bushfires and all other services.

COMPLETE WITH 1 CRYSTAL,

£32/10/-

TRANSCEIVERS

No. 11 less valves and meter,	£3/-/-
No. 11 including valves and meter,	£4/10/-
No. 19 less valves and meter.	£3/-/-
No. 19 including 15 octal valves and 500 micro amp. meter	£5/15/-

N.B.: All these units are in excellent condition. For original use parts or conversion.

CO-AX CONNECTORS
2/6 ea. 25/- doz.

NEW GAS FILLED VIBRATORS

12-volt.
Heavy-duty. Synchronous.
Suitable to 400v. 150 Ma.

£1/-/- Postage 2/-.

AR8-AT5—COMPLETE STATION

AIR TESTED

Transmitter-Receiver. Aerial Couple Cables, Plugs, Phones, Mike. 1 Crystal to desired Frequency. 24v. Power Supply and Circuits of 2 units.

GUARANTEED IN PERFECT ORDER.

£62/10/-

Other voltages available.

12V Lighting Plants

Johnston 300 watt direct coupled in 1 H.P. petrol engine. Tested. Perfect order.

£36.

NEW VALVES

217C	10/-	6E5	12/6
12C8	12/6	12K8	12/6
6J8	17/6	VT502	12/6
VT501	12/6	7A6	7/6
EBC33	12/6	AV11	3/9
1H6	7/6	832A	£3/-/-
6L6	20/	6K7	7/6
1C6	12/6	12SJ7	12/6
1G4	12/6	12SK7	12/6
1D4	12/6	12SL7	12/6
1J6	12/6	39/44	10/-
1K4	12/6	46	12/6
1K6	12/6	47	12/6
1LH4	12/6	78	12/6
1P5	5/-	828	£2/10/-
6A6	12/6	843	£1/10/-
3A4	15/	957	10/6
3B7	10/	1625	£1/-/-
3D6	10/	1629	10/-
6AG5	9/6	4307A	10/-
6AM5	15/6	1619	£1/-/-
6AM6	17/6	2050	£1/-/-
6H6	7/6	9001	8/6
6J6	15/-	RK75	10/-
6J7G	9/6	VR75/30	15/-
6N7	10/-	RK48A	£3/-/-
10	15/-	954	7/6
12A6	12/6	VR105/30	15/-
2A3	£1/-/-	1C7	4/6
KTW62/6U7	..	1A5	7/6
	7/6	7193	3/6
1M5	7/6	829B	£3/-/-
1D5	7/6	6G8	15/-
CV6	3/6	6B8	12/6
6F6	12/6	807	£1/-/-
VR65A/SP41		EL3NG	12/6
	2/6	83	10/-
KT66	27/6	EM1	12/6
806	£3/10/-	866A	15/-
1K7	7/6	6AC7	3/6
6X5	10/-	EF50	3/6
6V6	12/6	100TH	£2/5/-
1Q5	6/6	5R4GY	£1/-/-
811/	£1/-/-	6AJ5	9/6
X61M	17/6	EA50	3/6

NEW Indicator Unit

for that C.R.O. Project. 3 valves. VCR139A CR Tube, Cabinet, Socket Mount for Tube Pots, etc.

£3/17/6

NEW AIRCRAFT AIR COMPRESSORS

Complete with Filter.
Hi-speed. Ball Bearing.
2 cu. ft. per minute.
Ideal for small spray gun, etc.

£3/17/6

New Microswitches
6/6 each

Postage 6d.

NEW INVERTERS
200 WATT

50 cycle, 24 and 32v. D.C. to 240v. A.C. Ideal for radiograms, etc.

£25/-/-

NEW TRANSFORMERS

FERGUSON

VIBRATOR TRANSFORMERS

150 x 150 40mA. 6v.	£1	4	6
300 x 300 100 6v.	£1	17	6
325 x 325 125 12v.	£3	12	6

Inverter Transformers

6v., 240v. 40 watt	£3	7	6
12v., 240v. 60 watt	£3	7	6
32v., 240v. 60 watt	£3	7	6

C.R.O. TRANSFORMERS

350 x 350 extended to 1000v. 6.3v., 6.3v., 215v., 4v. .. £4/5/-
Postage: N.S.W., 5/-; Interstate, 7/6.

New A.R.B. Receivers

8 Valve
4 Band, 195 KC to 9.025 Megs.

24v. D.C. Operation	£22	0	0
Converted to 240v. A.C.	£33	15	0

RELAYS

6v. 3Ple Miniature	15/-
1700 SPDT	7/6
1300 SPDT	7/6
500 x 500 SPDT	7/6
12 volts DPDT 5 amp.	£1/-/-
12 volts DPDT	12/6
8-16 volts DPDT	12/6
11 volt A.C.	£1/-/-
Hi-speed Polarised relay,	£2/10/-
400 ohm	12/6
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½in Square Section DURAL TUBING UP 24 12ft lengths, 1/- per ft.

Hi-lo Phono Transformers	4/6
Spirit Level Bubbles, mounted,	4/6
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Hi-voltage Lead-thru Insulators,	1/6 each; 15/- doz.
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Torches, 2-cell Focusing	6/9
Multi-Strand 4-core Cable, yard 1/-; 100 yards	£2/17/6
Tx Var. Condensers, 300 pf,	£1/5/-
100 pf,	£1/1/-
60pf with Vernier	£1/1/-
30 pf	10/-

PHILIPS 60 WATT 8 VALVE

P.A. AMPLIFIERS
240v. A.C. operation.
Reconditioned. New Valves
Thoroughly tested.

£32/10/-

New Electric 24v to 32v Hydraulic Pumps

Heavy duty motor develops 1 h.p. cont. 2 h.p. intermittent. Ideal motor for operating power tools off 32v. D.C.

£1/15/-

Steanes P.A. Reflex Horn Speakers

O.P.T.X. 500 and 1000 fitted. New condition. **£22/10/-**

NEW HIGH IMPEDANCE HEADPHONES

£1/10/-

Postage 2/6.

New Smith Aircraft CLOCKS

8-day movement. Cost Govt. £28

2¼in	£4/15/-
2¾in with sweep hand	£5/15/-

New Coils and Intermediates Standard or miniature to suit all valves

Coils B/C 455 KC	9/6
Coils S/W 455 KC	9/6
Inters	11/6
Loop aerial coils	9/6
Slug tuned H.F. coils to suit 44 meg.	4/6

GENEMOTORS

Input.	Output.				
24v.	250v. 100mA	£1	0	0
24v.	550v. 375mA	£2	0	0
24v.	250v. 60mA	£1	5	0
12v.	500v. 350mA	£8	10	0
12v.	1200v. 200mA	£6	10	0
6v.	500v. 150mA	£6	10	0
24v.	250v. 100mA. New	£2	0	0
12v.	235v. 50mA	£2	15	0
12v.	350v. 50mA	£2	15	0

3BZ STATION

TRANSMITTER AS ABOVE.

Receiver 5 Band. 200 KC to 30 Megs, includes speaker and all accessories.

£92/10/-

TELEPHONES

Standard P.M.G. Type.
Pedestal Magneto Phones tested in perfect order.

£6/10/-

RECORDING TAPE

E.M.I. and Scotch Hi Coercity.
Excellent Condition. Ex ABC.

1200 ft. Spools	£1	8	6
600 ft. Spools		18	6
3250 ft. Platters	£2	10	0

TRANSCEIVERS
NEW No. 122 & 22

2 to 8 megs as above. Converted to Crystal Control. Power increased to 20 watts. Includes Plugs and Cables, Mike, Speaker, Circuit, 2 Crystals to wanted frequency conforms to P.M.G. requirements for small ships and other services. **£33/17/6**

WANTED

Communications Receivers, Test Equipment, P.A. Gear, Large or small surplus stock. Best prices. Call, write or phone any time.

Oil-filled Condensers

1UF	600V	6/6	5UF	2.5V	6/6
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10MFS 500 7.5UF 330V AC 10/-.

NEW 12V Genemotors

550v. 350mA	£8	10	0
250v. 100mA	£2	15	0

OSCILLATOR UNITS FOR 144 MEG. OPERATION
Complete with 2 Valves.

19/6

OSCILLATOR FOR 144 MEG.
Complete with 2—7193 Valves.

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Complete Audio Equipment

We are pleased to announce release of our high quality turnover cartridge incorporating the new low distortion stylus developed for our high fidelity pick-up.

The important features of this cartridge are

1. *Clip on stylus replacement.*
2. *Wide frequency response extending over 15 K.C.*
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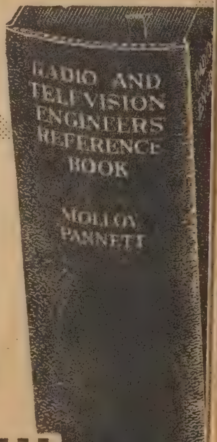

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HE INSIDE STORY OF SPUTNIK

(Continued from Page 5)

definite number of particles will have een counted. After the signal, to the fect that a definite number of particles ave been counted, is broadcast, the cosic ray particles are again recorded with new signal sent off as soon as the same umber of particles will have been ounted. By dividing the number of ecorded particles by the time in which ey were counted we shall obtain the umber of particles the counter gates ach second, or, in other words, we shall now the intensity of cosmic radiation.

The sputnik had two identical deices for recording charged particles. The xes of the counters in both devices were eciprocally perpendicular.

NORMAL OPERATION

Preliminary systematisation of sputik data on cosmic radiation has shown at both devices functioned normally. he dependence of the number of cosmic ay particles on the geomagnetic latitude as clearly discernible. Systematisation f the great number of measurements of e energy spectrum of virginal cosmic articles makes it possible to investigate e changes that come with time in this ectrum and compare them with the rocesses which took place at that time the outer space around us.

To study several medical and biolocal questions, the sputnik had inside a pecially hermetically sealed chamber ontaining a test animal (a husky named Laika"), measuring equipment to record e animal's physiological functions.

To regenerate the air inside the hamber and maintain the required gas omposition, highly active chemical comounds, giving off the necessary amount f oxygen for inhalation and absorbing arbon dioxide and the surplus of vapour, ere employed. Their amount in chemcal reactions was automatically conrolled. Due to the absence of air conection in conditions of zero-g, an rrangement for forced ventilation was stalled in the animal's chamber. A set ir temperature in the chamber was aintained by a heat regulating arrangeent. To give the animal food and ater during flight, the container had pecial feeding devices.

ZERO-G

At variance with earlier investigaions, the animal's travel aboard the sputik makes it possible to study protracted ffects of zero-g. So far zero-g effects ould be studied aboard aircraft, only ithin a matter of a few seconds, or in ertical upward rocket flights, only in he matter of a few minutes. The sputik makes it possible to study the condiion of a living organism in a zero-g tate lasting several days.

The research program involved in he taking of measurements by Sputnik o. 2 was to cover a period of seven ays. This has been carried out. The putnik's radio transmitters and also the adio-telemetering equipment have now topped working. Further tracking of he motion of Sputnik No. 2 to study the haracteristic features of the top layers f the atmosphere and forecast its flight, s being done optically and by radar.

TV TOWER TESTED WITH ROCKETS

During November, the BBC's new 707 foot tower at the Crystal Palace was tested for stability by imparting horizontal thrust to it with powerful rockets.

The National Physical Laboratory, which conducted the test, has already done the same thing on the tall concrete stacks of the Ferrybridge power station. But the Crystal Palace results may be sufficient to guide designers of all similar structures of open steelwork.

The aim was to see how the tower coped with vibrations of the sort that can be caused by steady winds. Some engineers were impressed with this problem for years before the war, but its full significance was not widely acknowledged until 1940, when a new suspension bridge collapsed into the Tacoma Narrows in the State of Washington.

The bridge earned the name "Galloping Gertie" because even during construction it heaved in the wind by as much as five feet.

There is a film record of the event which is both spectacular and instructive. In a steady 40 m.p.h. wind the bridge began to twist as well as heave. The designer, to show his confidence, had driven to the middle of the bridge, but when it changed its mode of oscilation the man came scurrying back to the bank before his bridge and his automobile fell together into the water.

The aerodynamic process is like that which causes telephone wires to gallop. A steady wind passing over a structure sets up vortices on either side of it. Thee vortices collapse first on one side and then on the other, and re-form.

There are thus alternating pressures acting cross-wind and, if the frequency of alternation matches the natural frequency of vibration of the structure, the vibration builds up.

Unless the structure is capable of absorbing the energy and damping down the vibration it may not survive for long.

So at Crystal Palace one rocket was fired to determine the natural frequency of the tower: it swung to and fro once in three seconds. Six rockets were then mounted 625 feet up the 710-foot structure, where they would excite this fundamental frequency but not the overtones. Then the rockets were fired at three-second intervals, so that each added to the swinging caused by its predecessors.

BANDSPREAD TUNER

(Continued from Page 33)

capacitors for the AVC and RF stage HT circuits close to the high-frequency coils. If so you can always use a .001 uF Hi-K ceramic close to the critical point and place the .01 uF near the lower frequency coils where there is more room.

Calibration of the dial will not present many problems to licensed amateurs, who are required to have a calibrated frequency meter in any case. If the transmitter has a variable frequency oscillator this should also be of worthwhile assistance, particularly if you have a few crystals to make checks at various spots across the band.

The job of calibration can be made much less tedious if you have or can borrow a crystal calibrator with a 100 Kc/s or a 50 Kc/s crystal. With the latter, especially, it is usually possible to interpolate fairly accurately down to 10 Kc/s points. Of course if you can hook up a 10 Kc/s multivibrator the job of calibration becomes a matter of quick and pleasant routine.

To return the bandset capacitors accurately to calibration points when changing bands some frequency standard is required. This can be the VFO or a crystal in the transmitter or, better still, a crystal oscillator built into the receiver itself.

With such a built-in calibrating crystal the receiver becomes quite an accurate frequency measuring device, provided the dial is well calibrated, since you can always return to the crystal check point to compensate for drift in the variable oscillator.

Know All About

TV

IN ADVANCE
the first Sydney TV
YEAR BOOK

THE
TV
BOOK
THE PROGRAMMES
The First Year Book
All About Television
KEITH WINSER

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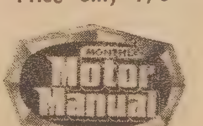

Enlarged! Featuring the 1958 cars and Stirling Moss autobiography! Big Touring and Repair Supplements. 2/6 all newsagents, or 30/ per year posted from

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351 Elizabeth St., Melbourne

No. 22 & 122 TRANSCEIVERS

The 122 transceiver covers a frequency of 2 to 8 Mcs. and has been approved by the P.M.G. for use on fishing boats, small craft, bush fire brigades etc.
These sets are supplied complete with valves, 12v. vibrator power supply, dynamic headphones and microphone, 6in x 9in. ovaltone speaker, leads, spare kit of valves and two crystals to required frequency. Range to 300 miles. Sets air tested. **£40.** F.O.R. These units in new condition.

The 122 transceiver as above but less crystals, speaker and spare valves not air tested. **£18.** F.O.R.

The 22 transceiver as 122 but not converted for crystal control, supplied with valves, meter, power supply, dynamic headphones and microphone. **£15.** F.O.R.

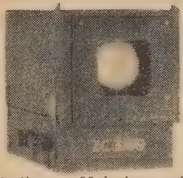
Transceiver only supplied with valves and meter.
£5/15/ F.O.R.

No. 19 TRANSCEIVERS

These units cover a frequency of 2 to 8 Mcs and contain 15 6.3 volt valves including 1-807, 2-6V6, 6-6K7, 2-6K8; 6B8 etc., also 500 micro-amp meter.
Units supplied complete with valves, leads, junction box, genemotor power supply and dynamic headphones and microphone (operate from 12v supply) Air tested.
£16/15/ F.O.R.

Set of leads and junction box for No. 19 Transceiver **20/** plus post and packing 10/. 12 volt Genemotor for 19.
£2/15/ F.O.R

NEW 3in R.F. METERS. 350MA or 1AMP
These meters can easily be converted to 10 or 100 mA meters, new scale supplied with meter. **7/6** Post 2/6.

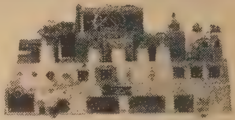


NEW INDICATOR UNITS

These new indicator units contain 3 valves controls etc. and V.C.R. 139A C.R.O. tube and socket. Ideal for that small scope.

£3/17/6
F.O.R

Indicator Unit less valves and C.R.O. Tube, 17/6 F.O.R.



RADAR RECEIVERS

These radar receivers type ZC955 contain 16 valves and a 30MCs. I.F. strip suitable for your TV experiment. Units are in new condition.
£3/17/6 Packing 15/- extra

BUILDING R. TV & H. 5in. TV SET

ALL MAJOR PARTS IN STOCK INCLUDING R.C.S., IF STRIPS AND TUNERS, VALVES, POWER TRANSFORMERS, CHASSIS, ETC.

NEW ALTIMETERS

FIT ONE IN YOUR CAR

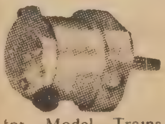
17/6

Post Free

NEW DYNAMIC HEADPHONES

These headphones made by Rola are a h[illegible] excellent tone
Fitted with comfortable ear pads
27/6 Post 4/6

24-VOLT MIDGET MOTORS SHUNT WOUND



Full Laminated Fields Wound Armature Sixteen Segment Commutator ball bearing. Ideal for Model Trains, Hobbyists, etc
Condition New
Price, each **32/6**
Packing and postage: N.S.W., 1/6; Interstate, 2/6.

VALVE SPECIALS

20/- will purchase any one of the following valve Specials

3	1P5	3	6K8G
5	1C7	5	6SH7
3	1Q5	6	6AC7
10	1K5	4	6J7G
5	954	4	KTW62/6U7
6	EF50	4	12A6
4	6C8G	2	6X5GT
10	VR65A	5	6K7G

Post and Packing, 4/6 extra.
ALL VALVES ARE NEW

NEW 6H6 OR 6H6GT VALVES

Individually Cartoned.

20/- per doz.

Post 2/6.

NEW TRANSMITTING VALVES

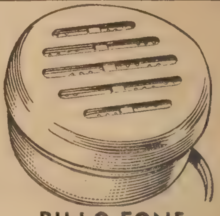
829B	£3/-/-
100TH	£1/10/-
866	15/-
811	£1

NEW MICRO-AMMETERS

New Paton Micro Ammeters. 0-500, M.A. 1¾in diameter Flush mounting.

30/-

Post and Packing 2/6.



PILLO-FONE

EXTENSION UNITS
IT'S A REAL MINIATURE WITH A ROLA UNIT

Install it anywhere in the sick-room, workshop, garage or any room in the house. Just connect across the voice coil of the existing speaker. The "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED

3½in Diameter by 1¾in deep. POST FREE.

22/6

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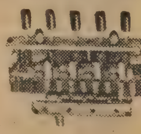

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6J5	12/6	1626	5/
6K7	6/11	1629	7/6
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3/8in	17	1/-
9/16in	17	1/3
¾in	17	1/9
7/16in	18	1/-
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ANSWERS TO CORRESPONDENTS

J.C.M. (Leederville, W.A.) points out that the OC16 transistor is now available and asks about ircuits using it.

A. We are watching the supply position on ransistors and will do something about using hem as soon as we feel it is warranted. Having been disappointed once in relation to the OC44 and OC45, we are not too anxious to move until we are sure that there are enough ransistors to meet the demand which articles reate.

J.G. (Port Kembla, N.S.W.) wants to know ow to deposit "silver" on an electric lamp o as to make portion of the glass reflective.

A. This is somewhat out of our line, J.G., nd we cannot offer much help. However, the o-called "silver" used is often mercury, though ve cannot advise on the exact method of application.

W.W. (Roseville, N.S.W.) sends a letter to he "Serviceman" detailing a rather interesting ault which had been overlooked by several proessional servicemen. He feels that the incident emphasises the points made recently in the Serviceman articles.

A. Many thanks for the letter, W.W., and we will pass your letter on to the Serviceman for his possible use in a future article. We feel sure he will find it interesting. In the meantime we would compliment you on the use of the thermometer to prove your point.

E.N.L. (Clayfield, Q.) has some LP recordings which contain sections that do not interest him and wants to know if it would be possible to cover the unwanted section with paraffin wax and inscribe a coupling groove across the wax to the next portion of the record.

A. The idea might work, E.N.L., but, frankly, we think it would be a lot safer to simply tolerate the unwanted sections. Paraffin wax would most certainly find its way into the following grooves, as you suggest, and something a good deal harder would be necessary. However, we cannot give the scheme our blessing, and would prefer not to see such records tampered with, particularly considering their price.

P.J.I.C. (Auckland, N.Z.) is anxious to get in touch with a tape exchange club in Australia and wants to know if we can help.

A. Sorry, P.J.I.C., but we have no address we could pass on to you. However, interested readers may be able to help, and we will publish your full name and address for the benefit of anyone who would like to contact you direct. The address is: Mr. P. J. I. Crookes, 39 Lammermore Drive, St. Heliers Bay, E1 Auckland, New Zealand.

C.B. (Annerley, Q.) is having motor-boating trouble with the audio oscillator described in July, 1949, and which he can only cure by carefully setting the feedback potentiometer.

A. We have never experienced this trouble, C.B., and the instrument is no longer with us, so we can only speculate. Our first reaction would be to check the second electrolytic in the power supply or, even if it is above reproach, try the effect of increasing this value. It is gratifying to learn that you have been reading our magazine so long, and that you have had so many successful projects based on the articles.

B.C.J. (Secombe Gardens, S.A.) wants to know if it is possible to connect two identical power transformers in parallel without any serious problems arising. He also tells us of a group of High-school boys he has formed into a club, and suggests that we publish an article on the current uses of the VHF bands; a subject in which his pupils are taking a lot of interest.

A. There should be no objection to connecting the two windings as you suggest, B.C.J., but it will be necessary to phase them correctly. This is most easily done experimentally, making a temporary connection with a scrap of wire and noting whether there are any sparks or other signs of distress. If so, reverse the connections. Your comments regarding your club are very interesting, and it is always gratifying to know that the magazine is helping such a worthy cause. Unfortunately we have no plans at the moment for an article of the type you envisage, but we will keep the idea in mind. In the meantime the FM tuner described a few months ago may serve as a basis for experiment and covers an interesting portion of the spectrum.

P.W.G. (Leeton Park, S.A.) wants to know what is meant by the terms "phone jack" and "regeneration."

A. A phone jack is a special type of socket to receive the plug commonly used on the end of earphone cords. Regeneration is another name for "reaction" or positive feedback, as applied to a detector in a radio receiver. It involves diverting some of the radio frequency energy from the output of the detector back to the input to increase the overall gain and selectivity. The principle is commonly used in simple one- and two-valve receivers but seldom in large receivers.

A.B. (Caulfield, Vic.) asks a number of questions which we will try to answer briefly.

A. Where a separate diode is used for AVC, it does not matter a great deal whether it is fed through a capacitor from the plate of the preceding valve or from the detector diode. We must plead guilty to being inconsistent in the case mentioned but the end result would not be affected. Whistling on stations might indicate that the receiver is unstable, possibly due to having active leads too long or wrongly placed. Alternatively it may be due to the use of a poor aerial coil or to misalignment, particularly of the IF channel. Having the IF channel on the wrong frequency, when operating the set close to stations in the centre of the band can cause queer effects. There is no particular reason why the bass control in your control unit should not have the effect intended for it. It is important to note, however, that the effect will only be appreciated if the input signal contains low frequencies in the first place and the speaker is properly baffled to reproduce them.

V.L.S. (Whyalla, S.A.) asks a question about FM demodulators.

A. We have put your letter aside for possible use in the Answer Tom page. Thank you very much for your appreciative remarks.

C.R.B. (Wavell Heights, Qld.) wishes to build a small cathode ray oscilloscope and asks about the possibility of using either of two cathode ray tubes he already has on hand.

A. Sorry, but a quick check of available data failed to yield any data on the tubes you mention. Type 6AC7 makes quite a good oscilloscope amplifier but circuit conditions should be different from those for the 6AU6 amplifier you mention. (See August, 1956, issue.) We have heard of cases of radio programs being audible close to powerful transmitters due to rectification in pipes, etc. Apparently in the case you mention the presence of the water was required to complete the rectifying action.

B.C. (Bathurst, N.S.W.) would like to see us describe a simple receiver for receiving signals from earth satellites.

A. If we were convinced that a fair proportion of readers was interested a receiver could be described but there are difficulties in the case of people with limited measuring equipment. For example, there is the matter of establishing the exact frequency since the signals are not audible long enough to allow it to be determined simply by tuning around. Glad to note that the articles on the 5in TV receiver were of interest.

No NAME (Croydon, Vic.) sends us a circuit of a simple crystal set made from a disposals variometer and suggests that it may be used in the Reader Built It section.

A. Many thanks for your letter and the description of the set. Unfortunately we have already described something very similar, but the idea may be worth repeating at a later date. Incidentally, we like to have the name and address of our correspondents, even if these are not to be published.

R.P. (Flora Hill Vic.) has been inspired by one of our recent crystal set designs to detail at some length the various calculations involved in designing the coils we specified, and suggests that many readers might be interested in this approach.

A. Many thanks for your letter R.P., and also the suggestion. While we appreciate soundness of the basic theory you set out, we feel that this is rather outside the scope of the type of reader who is interested in crystal sets. In fact, it usually works out in practice to be quicker and easier to determine such things experimentally than by calculation, even assuming that the person concerned is able to handle the necessary maths. Further point is given to this "practical" approach by the fact that, for any other type of set, it is nearly always possible to buy commercial coils of far better quality than the amateur can wind by hand. However, we will keep your idea in mind as a possible subject for discussion at a latter date for those who might be interested in the essential basic principles.

F.S. (Pennant Hills, N.S.W.) wants to know how the plates of a 6AL5 operating in a ratio detector circuit receive any HT. He also wants to know whether it would be possible to operate such a detector as a one valve FM receiver.

A. We feel that you need to get quite a few things straightened out F.S., since it is not possible to carry over many of the ideas previously encountered in broadcast band AM working. In the first place there is no HT on the plates of the 6AL5, their function being essentially one of rectifying the signals fed to them. While it might be possible to get some results from the simple circuit you suggest, it would be extremely insensitive and virtually useless unless the transmitter was nearby. A discriminator transformer would most certainly be necessary and it would have to be able to tune to the signal you wished to hear, which could make its design extremely difficult. We suggest you try to follow some of the recent discussions in the Course in Television on this subject.

J.D.B. (Sandgate, Q.) wants to see a parts list for the simple CRO circuit described October, 1957 issue.

A. This circuit was intended simply as a guide for those readers who had sufficient experience to select their own components, and we regret we cannot undertake to prepare a parts list at this stage. The power transformer need not have a very large rating and almost any commercial type having the correct voltage rating would be adequate. We are afraid the layout is something you will also have to work out for yourself, since there are so many possibilities and variety of cases in which it may be housed.

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To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

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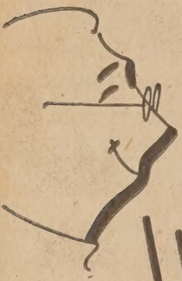

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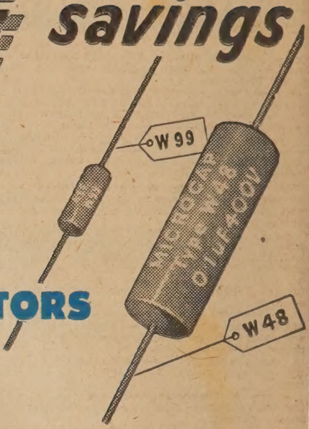
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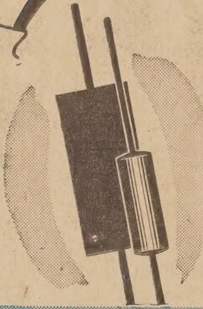

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ANSWERS TO CORRESPONDENTS

A.E.T. (Elizabeth Sth, S.A.) wishes to know if we are able to supply constructional details for a Jetex or similar jet engine for model plane work, also details of a transmitter and receiver for the same purpose.

A. We regret that we are unable to supply any specifications for the construction of a jet engine of any type. We suggest that you seek the necessary information either in publications devoted to aero-modelling or in books, of which a number have been written on this subject. A series of articles on remote control of models was featured in our journal commencing in September, 1950, and terminating in November, 1950. However, reprints of the article or the circuits are not available and we suggest that you contact your public library for photostat copies, etc.

A. C. R. (Christchurch, N.Z.) writes to express his interest in the Course In Television and his wish to see it in book form. A. C. R. goes on to outline the advantages and benefits of such a publication and the appeal this is likely to have to the people interested in the course.

A. Whilst we agree with you A.C.R., and acknowledge a number of similar requests, we are unable to promise anything definite for the present. We are pleased to note your interest in our Course In Television and trust that it will continue to hold your interest in its present form.

A. W. B. (Bentleigh, Vic.) asks for advice on the constructional details of a transistorised personal portable.

A. We regret that we are unable as yet to supply any constructional details of transistorised portables. The supply position regarding suitable transistor types is very poor while suitable associate components are not available. We feel that the position at present is not sufficiently clear to warrant the design of suitable circuitry and components.

K. F. (Mascot, N.S.W.) writes in to ask if headphone bobbins could be used as record and playback heads in a tape recorder.

A. Headphone bobbins are quite suitable for use as tape heads and a constructional article on home-made tape heads using these, was featured in a past issue. Reprints of this feature are available through our two-shilling query service.

B. B. (Taringa, Vic.) requests for details of a circuit diagram and other information on a valve tester. Also the date of the issue featuring a Playmaster amplifier using 6V6 output valves.

A. We are unable to supply any details on the construction of a valve tester nor are we able to suggest any suitable source of information. A valve tester is a complex instrument requiring very special switching arrangements and accurate calibrations for it to be useful. Until we can solve these problems, its construction must be outside the scope of the average constructor.

The Playmaster amplifier using 6V6 output valves was classified as the No. 2 and featured in the November, 1951, issue.

J. W. (Fitzroy, Vic.) forwards a query for the Answer Tom feature concerning the use of sharp cut off 6AC7's in our TV IF strip.

A. We note your query which has been filed for future use in the Answer Tom feature.

P.J.K. (Auckland, N.Z.) has just completed a tape recording amplifier and is at loss to know where to connect a tuner to enable him to record radio programs.

A. As we are not familiar with the specific circuit that you describe we can only suggest on assumptions based on previous experience with equipment of this nature. Since the output of a tuner is comparatively high it is desirable to feed the tuner output into a low sensitivity stage. This would rule out the first stage, which is normally intended for microphone input. As a rule this feeds into the recording gain control potentiometer and the output from the tuner could well feed to this same point.

N.C.D. (North Collee, W.A.) writes to suggest additions to the 1957 Little General to suit the country listener. N.C.D. feels that it should be possible to convert this circuit to an inexpensive radiogram with improved sensitivity.

A. Your suggestions are quite sound and the project should be feasible. Unfortunately other pressing editorial matters must be attended to and we must file your suggestions for possible future consideration.

D.W. (Beaufort, Vic.) tells of his experiences with a small receiver using a loopstick aerial.

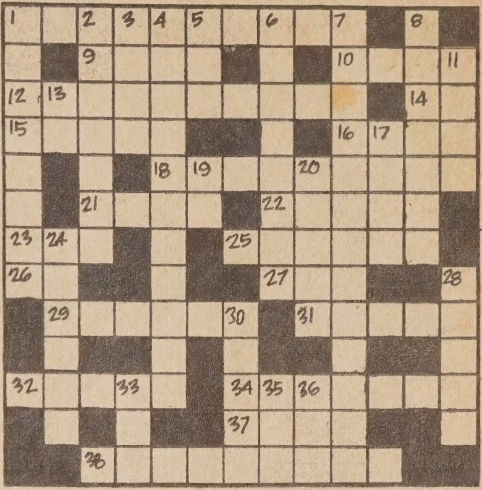
A. Your experiences are in line with what we would expect but, as you say, they might help another reader. They are set out below and we quote:

"I recently built a three valve regenerative receiver employing a standard loopstick of a well-nkown make. I found that the length of the aerial determined the position of the station on the dial. However, I discovered that by making a small cylinder large enough to fit over the loopstick and about one inch in length, and winding approximately eight turns of appropriate wire and joining the two ends together, I could, by sliding the coil along the loopstick, alter the position of the present signal to its proper position on the dial no matter what the length of the aerial was."

THE R., T.V. & H. CROSSWORD No. 44

ACROSS

1. Control knob on a TV set.
9. French for island.
10. Curved section of a bridge.
12. Production of ions from an electrically neutral substance.
14. Royal Institute (abbrev.).
15. To deceive.
16. Happy.
18. Submarine viewing device.
21. Country in the Middle East.
22. Solitary.
23. To possess.
25. Woodworking tool (pl.).
26. Point on a compass.
27. Man's name (abbrev.).
29. Type of plant with star-like flowers (pl.).
31. Unit of attenuation.
32. One more than six.
34. Heaps up together.
37. Young male attendant.
38. Components having resistance.



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DOWN

1. Resistance a moving body meets with in the atmosphere.
2. Noval.
3. Pen name of Charles Lamb.
4. Oscillograph picture indicating the function of equipment (2 words).
5. United States of America (abbrev.).
6. First letters of a name.
7. Assembly of two or more variable capacitors (2 words).
8. Rubs, scratches.
11. Skin of a beast.
13. Exclamation of surprise.
17. Solitary.
19. Prefix meaning in, with.
20. Put to death by violence.
24. Frailer, feebler.
28. Implement made of bristles.
30. Breaks.
33. First woman.
35. Floor covering.
36. In time past.

Solution and further crossword next month

K.C. (no address): I am interested in your 5in television receiver. Would it be possible to simplify it by dispensing with two of the three video IF stages and one of the two sound IF stages? It is noted that there are a number of 17in receivers on the market which apparently work quite well.

A. In a strong signal area, it may be possible to eliminate a number of stages and still get a usable picture but, quite frankly, we are not in a position to say how far such a scheme could be pushed.

One of the obvious difficulties is that television signals vary greatly in strength, even over a given area, and we would be loath to publish a design which had such limited gain that its ultimate performance would become a gamble. From our point of view, it is always better to provide a "safe" design than one which is "cut to the bone" and which no one can be sure about utnil they have actually switched it on at their own home.

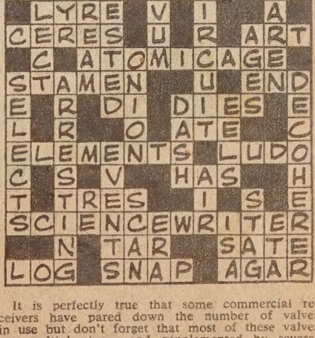
To discover at that stage that the thing needed to be rebuilt for their location would be frustrating indeed.

There is more to it also than just gain. The elimination of stages involves the elimination of tuned circuits and, with them, the facility of getting the proper pass band. A 5in receiver is not very critical in regard to pass band but, somewhere along the line, the loss of performance must become evident and be reckoned as not worthwhile.

In the video amplifier itself, we used two amplifier stages, as much as anything to get the right picture phase for a 5BP1 grid, Eliminating one stage would involve reversal of this phase and other changes in the circuit to put it right again.

It is perfectly true that some commercial receivers have pared down the number of valves in use but don't forget that most of these valves are multiple types and supplemented by several germanium diodes. It is almost inevitable that the number of valves in a "disposals type" receiver will be higher, if only becuse the valves are single-purpose types with only one set of electrodes.

Last month's solution



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ANSWERS TO CORRESPONDENTS

B.L.R. (Malvern, Vic.) has recently come by an old receiver using valve types 80, 47, 35 and 57. He wishes to know if a circuit of the same would be available, and whether it is worth while salvaging and keeping any of the components. B.L.R. concludes by making some appreciative comments regarding our journal.

A. The receiver you have acquired is undoubtedly a veteran and it is unlikely that a circuit of it would be available. In any case it is hardly worth repairing since many of the components would be doubtful. If you must salvage any components, those above the chassis will most likely be in working order. Resistors and capacitors, particularly capacitors, will be suspect.

Several receivers based on salvaged components, have been featured in our journal, the latest being the Basic Four and the Basic Five These were feateured in the March, 1956, and the December, 1955 issues respectively.

Many thanks for your comments B.L.R.

R.F. (Newcastle, N.S.W.) forwards a circuit for comment and describes a method of improving crystal-set performance. The method consists of connecting a Reinartz coil in series with the aerial R.F. claims it improved selectivity and sensitivity.

A. The method you describe is most unusual and while it functions, we feel that the same result may have been obtained by the use of series capacitor and/or a suitable wave trap. The effect of the series inductance is most likely similar to that of a series capacitance in reducing the effective length of the aerial and hence the loading effect on the coils. This would alter the selectivity as well as the sensitivity. Much the same effect might also have been obtained by using a somewhat shorter aerial. There is just the possibility, of course, that the coil was acting as a normal wave trap, limiting the signal from a strong local station. Either way, the effect is more of a "happy accident" than being technically significant.

A.N. (Ryde, N.S.W.) has some appreciative comments to make regarding our effort on the 17in and 21in TV sets. However, A.N. would like to see more sketched details of other sections of these receivers to aid amateurs like himself.

A. We thank you for the appreciative comments and suggestions regarding our television receivers; however, we feel that we have devoted sufficient time and space to these projects. We regret that we are unable to elaborate any further on the wiring details or we will make ourselves thoroughly unpopular with readers who think we have already given too much prominence to television.

I.B. (North Sydney, N.S.W.) writes in to express his appreciation of our journal, particularly the Simple Course in Radio. I.B. goes on to offer suggestions on articles dealing with the construction and operation of electronic devices as used in industry and medicine.

A. Many thanks for your appreciative comments, I.B. We trust that you will continue to enjoy our publication. Your suggestions regarding the electronic equipment are appreciated and we shall keep these in mind.

THE HAZARDS OF LIFE IN SPACE

(Continued from page 13)

tor in space medicine—the psychological reaction to extremes of physical stress and danger, and to the strange, weightless prison life of the space vehicle. Emotions are liable to be uncontrollable, and not only must individuals pass psychological tests but where there is to be more than one in the party they will have to be well-matched.

None of the experimental and theoretical predictions of physics or physiology suggests that man is unfitted for space travel or that he requires such elaborate protection as would defeat the engineer. But there remains a number of unanswered questions, and no one ought to venture far until the animals and the sputniks have provided most of the answers.

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